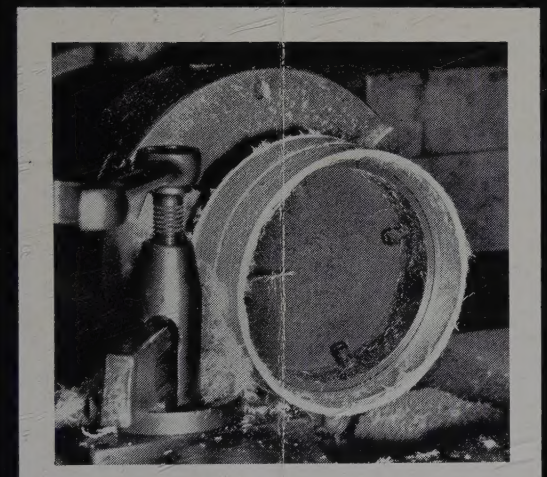
November 1961

Insulation



Stronger banding tape . . . page 25

In this issue:

WHERE RELIABILITY COUNTS

BEN HAR 1151

EXPANDABLE SLEEVING

At **WESTINGHOUSE** the use of BEN HAR 1151 has resulted in significant cost and time savings in the production of their luminaire lighting equipment (Street Lighting Luminaire #OV-25). The inherent toughness of BEN HAR 1151, an extrusion coated expandable fiberglass silicone rubber sleeving, has reduced rejections, given improved transformer lead protection and reduced the sizes of the sleeving required. (This size reduction resulted in a 28% savings in material alone.) Dielectric protection remains excellent.

BENTLEY-HARRIS

MANUFACTURING CO.

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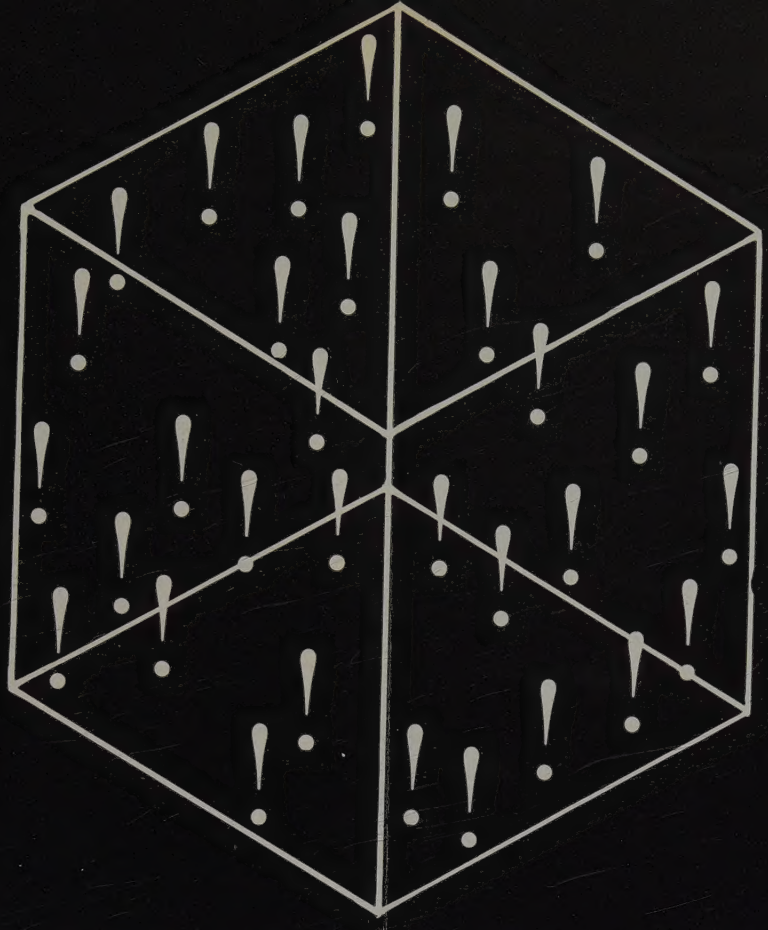

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Prehler has one of the biggest warehouses crammed with every type, size, and shape of insulation
ial in order to give you "yesterday" delivery. But from a nuts and bolts service standpoint, there
torehouses less than a foot square which are probably more important. We're talking about the
ouse of insulation ideas which every Prehler man carries about in his head. Prehler men have met
olved virtually every type of insulation material and application problem in their years of experi-
—this, combined with sound, fundamental know-how and creative thinking adds up to quick, intelli-
and economical service. There's no charge for using the Prehler storehouse of ideas . . . phone or
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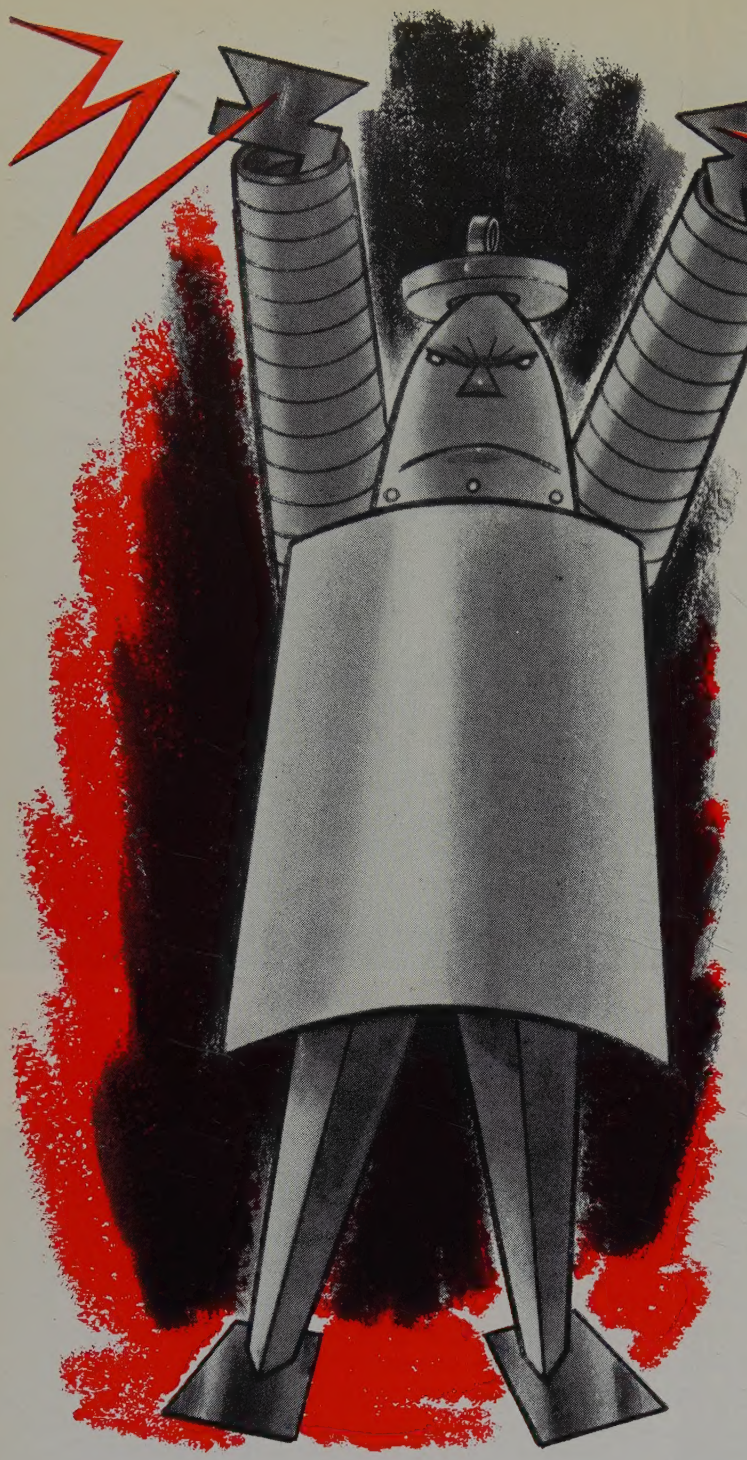

MACALLEN BUILT-UP MICA MAKES BETTER INSULATION BECAUSE OF ITS

HIGH DIELECTRIC STRENGTH

1000 volts per mil, excellent resistivity, low dielectric loss and maximum stability of electrical properties under practically all atmospheric conditions — these are but a few of the reasons why Macallen Built-Up Mica is one of the best insulating materials available today.

And Macallen Built-Up Mica is *tough!* It withstands extremely high temperatures. It won't burn.

Macallen Built-Up Mica is also *versatile.* It comes in many forms — from tubes, tapes to sheets — and in many sizes. It can be made flexible or rigid; given varying degrees of hardness, compressiveness or physical strength. It can be made for punching, drilling, sawing, or molding.

No other material has all the electrical insulation qualities of mica. And no one knows how to make better use of them than Macallen. Find out how Macallen Built-Up Mica can solve your insulation problems. Write for Catalog 26 today. No charge or obligation.

For the most in mica — specify Macallen . . .

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Insulation

For the Electrical and Electronic Industries

Lake Publishing Corporation, 311 East Park Avenue, Libertyville, Illinois, November, 1961
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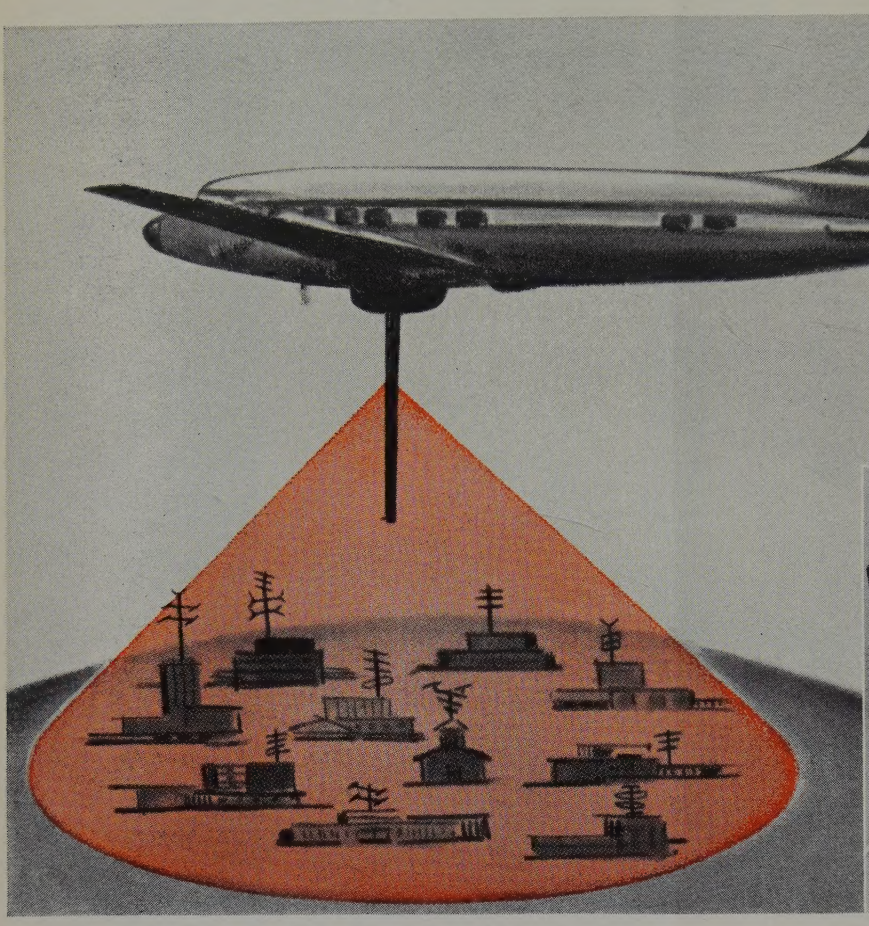
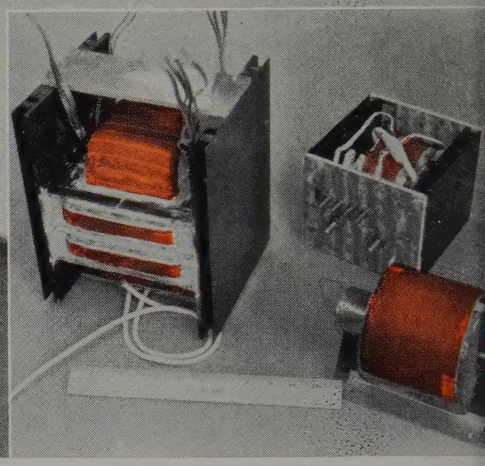
Design for the future





TV antenna 4½ miles high for more school coverage

Educators across the country are watching closely a new approach to TV classes which may reduce sharply the growing costs of education and relieve the teacher shortage problem. Video tape lectures will be transmitted from two DC-6's converted by Westinghouse engineers into powerful aerial transmitting centers. From 23,000 feet, the airborne TV signals will have an effective range of 150 to 200 miles — up to 12 times the area coverage of the 60 to 70 mile range offered by ground based transmitters. What's more, each plane is equipped to transmit as many as six lectures simultaneously on each of two channels.

To save weight, reduce bulk and assure reliability of this complex airborne telecast equipment, Dow Corning silicone insulation was specified on four major power supply components.

Guideline tape made of Silastic®, the Dow Corning silicone rubber, protects windings in each of the three phases of the 16-KV rectifier transformer rated at 35 KVA, 400-cps.

Silastic, together with other silicone insulating components, was also used for the 9-KVA, 3-phase buck-boost transformer and for the filter choke consisting of two units rated 0.5 henry at 3 amperes.

Combined weight of these silicone insulated power supply units with their forced-air cooling ducts is 265 pounds. Westinghouse Air Arm engineers estimate that Class A insulated units of the same ratings would be more than twice as heavy. Bulk is also reduced substantially.

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first in silicones

Dow Corning

..with these silicones

ilicone-glass laminates defy heat

onded with heat stable Dow Corning silicone resin, glass minates don't lose their grip on terminals during ldering . . . permit designs that work copper and elec- ical steel harder for longer, more efficient equipment life. Videly used for terminal boards and coil forms in electrical nd electronic devices — for coil dividers, slot wedges and p sticks in motors. Silicone-glass laminates offer high arc sistance, low loss factor, low moisture absorption . . . xcellent mechanical and dielectric strength even after rolonged aging at 250 C.

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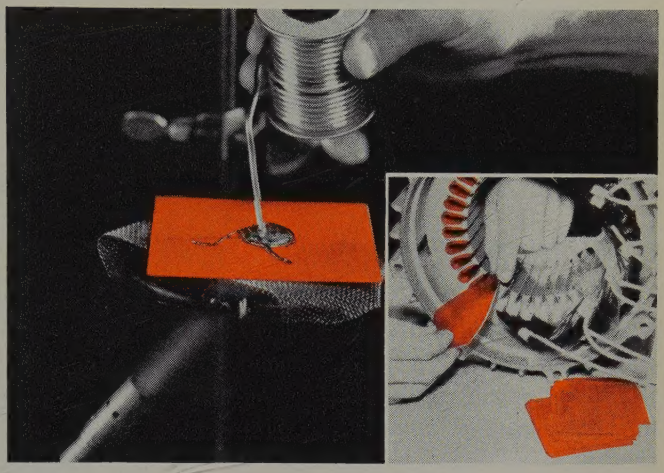

ilicone compound seals out trouble

ow Corning 3 Compound is a ready-to-use grease-like licone potting, filling and coating material that retains s initial physical properties, resists oxidation . . . has xcellent dielectric properties. That's why Elastimold ivision of Elastic Stop Nut Corporation of America, lackettstown, N. J., uses it to fill the molded rubber ousings of their new underground and overhead cable onnector kits. This compound fills all voids in the con- ector housing . . . prevents corona, excludes moisture and ases on the job assembly.

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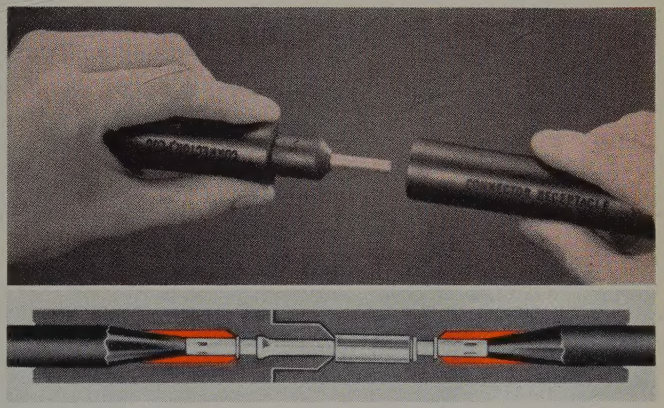

More KVA per pound with silicones

ry-type transformers are smaller in size, lighter in weight – and more reliable — when designed for a silicone insul- tion system. Reason: heat stable Dow Corning silicone arnish and silicone components assure designs that work onductors and electrical iron harder . . . more efficiently. hat's why designers at Acme Electric Corporation, Cuba, lew York, combine the outstanding properties of a silicone nsulation system with grain oriented silicon steel, alumi- um and copper conductors and a unique induced air ooling system in their wall mounted transformers designed or easy installation . . . long, trouble-free life.

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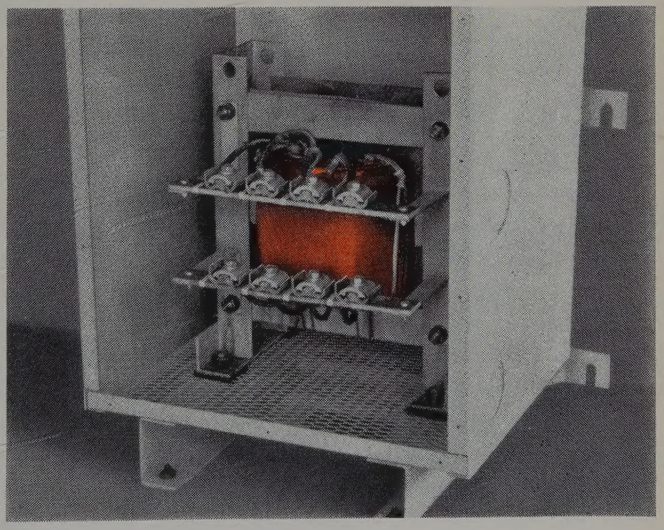


ow Corning Corporation, Midland, Michigan is your number one ource for information and technical service on silicones.

From the Editor

Opinions and Rambling Thoughts

For the Man Who Has Everything

We see by the news releases that Ultrasonics Industries Inc. has developed an ultrasonic ball point writing instrument which requires no writing fluids or marking compounds and is capable of writing at a linear speed of 9,000 feet per minute. The marking reportedly is unaffected by sunlight, temperature, or water. It can be used under water and will write upside-down or in any other position.

We readily endorse this instrument as a gift for that "hard-to-buy-for" person in your life who likes to dash off letters at a writing speed of 9,000 feet per minute while swimming around in a tank of boiling water in an attempt to find the bottom of an iceberg which would give a better writing surface.

Subsidies

A reader, after seeing our September editorial on the elimination of all tax exemptions, was prompted to write us about one of his pet peeves—postal subsidies which permit some to enjoy special below-cost postal rates. He felt that *Insulation* was one of these favored few (or many) and that while it cost him 3 cents to mail us a post card, we could mail to him a much heavier magazine for a fraction of 3 cents.

Just to set the record straight, we are against all subsidies including low, unprofitable postage rates for non-profit organizations, favored magazines, etc. And we will be happy to join a lobby which would fight such favored treatment. A number of publications you receive are probably mailed at second class postage rates—such publications not only pay extremely low postage rates, they also receive favored treatment as far as speed of handling and delivery is concerned. *Insulation* does not fall into the second class postage category . . . instead, it is mailed as a "controlled circulation" publication at a rate of 12 cents per pound (about 9 cents per copy for an average issue) which is much, much higher than the amount paid by the second class publications. We suspect that the Post Office makes a profit on *Insulation* since all copies when addressed are completely sorted for the Post Office and there is no post mark which requires cancellation. However, if the Post Office is not making a profit on our magazine, we will readily accept a rate increase . . . providing the second class publications pay the same rates. We have the rather prejudiced point of view that the magazine we deliver to our readers is more valuable than other magazines including ones mailed at second class rates, but regardless of value, we find it impossible to understand why some magazines should be favored over others in regard to postage rates.

Electrical Insulation Conference

It isn't too early to start planning to attend the Electrical Insulation Conference in Washington, D. C., Feb. 19-22. A copy of the tentative program for the technical sessions and news on other activities appears on other pages of this issue. All indications point to the fact that the forthcoming conference will be the best yet—be sure not to miss it.

Firming Prices

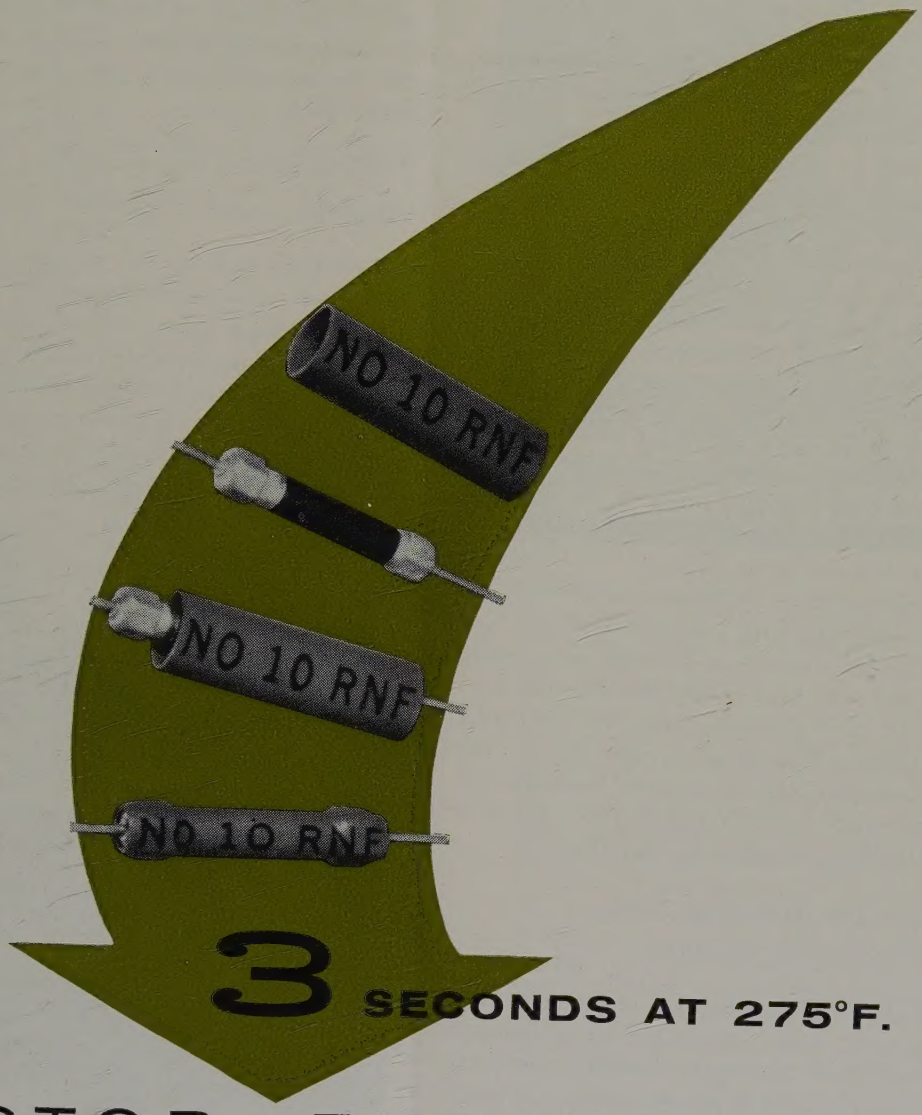
Although most buyers will disagree, we must admit that we are somewhat encouraged by the recent beginning of what we hope is a trend to establish better and firmer prices for many materials. The results can often be disastrous where low prices are based on cut-throat competition, reduced service, curtailed research activities, etc. Some of the recent price increases and reductions appear to indicate that once again industry is determined to establish prices on a realistic basis.

Savings Via Standardization

The fact that the adoption of standardization programs can save companies substantial amounts of money is often overlooked because the use of standards may be dictated for other reasons. In view of this, a questionnaire survey recently conducted by the American Standards Association is of interest. A total of 67 companies responded to the questionnaire and without exception, all of them stated that their standards activities had contributed substantially to reducing costs. Some 15 companies gave specific savings information and on a percentage basis, the savings ranged from 1 to 20% of gross income. On a dollar savings ratio, other companies reported a range of $3 to $3 gained for each $1 put into standards work.

We Could Have Told Them

Bell Telephone Laboratories has disclosed the results of a survey which show that men speak louder than women on the phone but women make the most social calls. It's too bad Bell didn't consult us before spending all that money on the survey—we could have told them the same thing for free.



RESISTOR ENCAPSULATION

THERMOFIT®

Thermofit sleeves simply are dropped over the resistor by hand or machine. They then **shrink tightly** upon brief heating, **gripping** the resistor and becoming a **moisture tight** casing. Heat lamps or ovens allow thousands per hour to be encapsulated.

Available in a wide range of sizes and materials, marked to specification, long lengths or cut pieces, clear or colored. All types offer high dielectric strength, abrasion resistance, and outstanding environmental protection.

RAYCLAD TUBES
INCORPORATED

OAKSIDE AT NORTHSIDE • REDWOOD CITY, CALIFORNIA

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News and Views

Allied Chemical Joins Others In Polypropylene Market

Effective this month, Allied Chemical's Plastics Division has entered the polypropylene market. According to Division President Frank M. Norton, marketing demands will be supplied through a working arrangement with a present manufacturer producing materials to the firm's specifications. With this move, Allied joins nearly every other major resin producer in the polypropylene market—in recent times, just about all companies who previously were not producing polypropylene have announced plans for their own production facilities or arrangements for obtaining the material from others.

New Insulation Company Formed

The recently organized firm of Inmanco Incorporated has taken over all equipment, tools, and inventories of the former Inmanco Manufacturing Division of Insulation Manufacturers Corporation, Chicago, according to A. Shirley Gray, administrative vice president and general manager. The new company will operate as a totally owned and operated subsidiary of The Macallen Co., Inc., Newmarket, N. H. mica insulation producer. Insulation Manufacturers Corp. will continue to specialize in the distribution of a complete line of electrical/electronic insulation materials while Inmanco Inc. will function as a converter and fabricator of insulating materials.

New Technique for Reducing Size And Cost of Electronic Products

According to *Aerospace*, publication of the Aerospace Industries Association, a new process has been developed for precision welding of small parts and thin metals. It is reported that the process will permit assembly of miniature parts into tiny electronic units that eliminate circuit boards and reduce the length of component lead wires.

Price Changes

The Silicone Products Department of General Electric has reduced the price of LTV-602, a new clear silicone potting and embedding compound for electrical/electronic uses, by $1.00 or more per pound. Quantity price is now $5.90/lb while the one pound price is $9.50.

Union Carbide Plastics Co. has joined some of the other producers in a price increase on general purpose and medium impact styrene compounds—the increase is one cent per pound.

A four-cent reduction in the price of two long-term, heat-aging polypropylene grades has been announced by the Plastics and Resin Division of Enjay Chemical Co. The new 42¢/lb. price for Escon 125 and 522 in 20,000-lb. lots is the same as for general purpose grades.

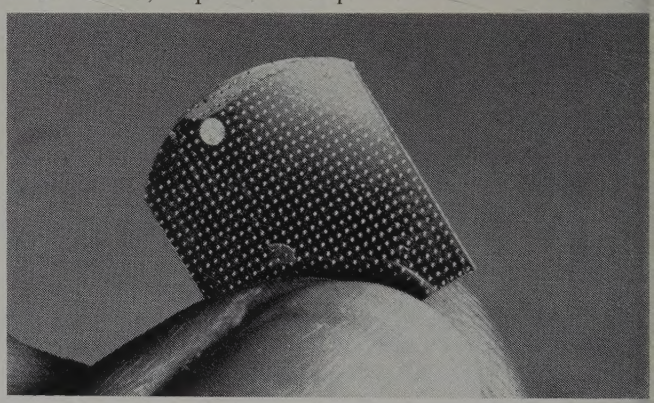
Celanese Polymer Co. has raised the price of certain grades of cellulose acetate molding compounds and flake some 2 to 6 cents per pound. Prices now range from 41 to 52¢/lb. in carload quantities depending on the type of material.

Fluorosilicone Fluids with High Dielectric Constants

Dow Corning Corp. has introduced a new line of heat, cold, and oxidation-resistant materials—fluorosilicones—which include a group of fluids which have high dielectric constants on the order of 6.9 to 7.3 at 100 cycles at room temperature. Although the high dielectric constant is a disadvantage in some electrical applications it is desirable in many electronic applications. The fluids may also offer advantages as plasticizers in rubbers and plastics.

Micro-Thin Glass Film

A new high-volume method for sealing high reliability into microminiature diodes and transistors which uses a film of glass only .0001-inch thick has been reported by the Components Division of International Business Machines Corp. The technique uses intense heat, over 1500°F, to produce the protective film in the simul-



taneous sealing of thousands of microminiature devices. Sealing against moisture and other atmospheric contaminants is essential in many cases. In photo, glass, which is a thousand times thinner than a window pane, protects several hundred tiny diodes on this section of silicon wafer.

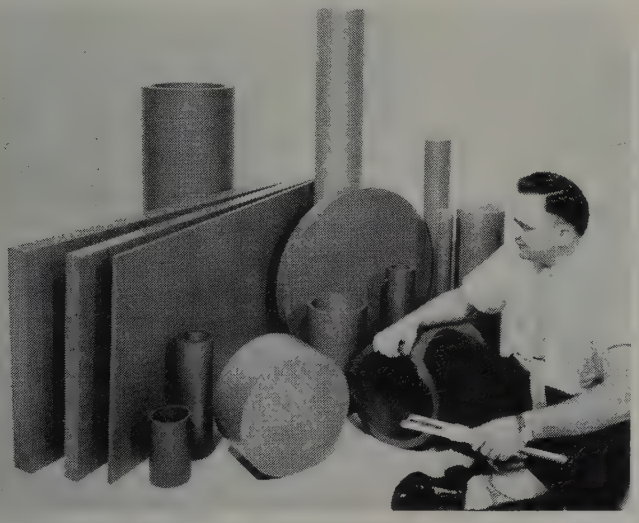
Lighter, Less Costly Transformers Without Insulation and Heat Problems

Transformers which could be considerably lighter and less costly than conventional transformers and which would not be subject to the substantial power losses caused by electrical heating, or to the temperature limitations of present-day electrical insulation, were described at a recent AIEE meeting by the inventor, Dr. Richard McFee,

of Syracuse University and Arthur D. Little Inc. The new design makes use of superconductivity—the ability of certain metals to conduct an electric current without any resistance at temperatures near absolute zero (—459.6°F). Although considered in the past, the problem with such transformers was that a moderately strong magnetic field could quench the superconducting state by restoring electrical resistance. However, Dr. McFee has discovered that interleaving layers of the primary and secondary windings would keep the total magnetic field strength below critical levels. A transformer of the new design has been operating successfully at a level of 15 kw.

New Process for Massive Nylon Plastic Shapes

A new nylon casting process which for the first time permits low cost production of massive nylon plastic shapes has been introduced by the Polymer Corp., Reading, Pa. The process is reported to be quite similar in techniques



and costs to the conventional casting of metals. The material, designated as MC nylon, is a Type 6 nylon formulation. The direct production of finished nylon parts from monomer rather than powders of nylon polymer is claimed to cut raw material costs in half.

Design Prevents Corona in Extra High Voltage Transmission Connectors

According to scientists and engineers with Thomas & Betts Co., Elizabeth, N.J., on-location testing has shown that corona in extra high voltage transmission connectors can be reduced to a minimum approaching zero. In tests up to one million volts phase-to-phase, using a four-conductor bundle of 1.6 inch diameter cable, corona free performance has been attained. The connectors have been designed to exceed the strength, conductivity, and corona characteristics of cables. As a result of preliminary findings, T&B engineers are incorporating tapered shapes for connector ends in the standard line. Previous tests at the Apple Grove, W. Va. 750-kv power transmission test site indicated that cable-end corona suppressing devices were no longer required for satisfactory performance of splicers, tap connectors, terminals, and deadend bodies.

Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

What do you think will be the most important challenge to be met by the electrical/electronic insulation industry during the coming decade?

H. L. Thomas

Director of Laboratories, Ren Plastics Inc., Lansing, Mich.

"It is difficult to decide which area might be the most important among the many challenges which confront the electrical and electronic insulation industry now—and in the future. In these days of miniaturization, microminiaturization, and submicrominiaturization, better handling characteristics and higher dielectric strengths will be essential. Certainly, one of the most difficult problems will be the development of insulating materials capable of withstanding extremes of temperature, both high and low, and capable of resisting thermal shock.

"Just a few years ago, no organic insulation could be used at temperatures above 105°C. More recently, the limit has been pushed to 150°C. Today, plastics laboratories are beginning to produce organic insulation capable of being used continuously at or near 300°C.

"Although organic insulating materials will undoubtedly reach higher temperatures of usefulness (some of the organo-metallics have already been used experimentally for a few seconds at 550°C or a few microseconds at 800°C), the real future of chemical insulation lies in inorganic polymers and coatings. One of the primary advantages of inorganic insulation materials is the fact that thermal coefficients of expansion more closely approximate those of metals than do organic polymers. In general, their thermal conductivities more nearly approximate those of metals, and they can be made inherently abrasion resistant.

"The thermal properties of inorganic insulating materials will allow their use, not only at very high and very low temperatures, but also under conditions of rapidly changing temperature (thermal shock). The developments needed involve materials easier to apply, and more efficient methods of application of the insulation and assembly of parts. Some necessary properties are resistance to various atmospheric conditions and chemicals, including water, and retention of insulating and physical properties on cycling from very high temperatures to very low temperatures and back.

"Most of us realize that considerable work on inorganic polymers is already underway, both in this country and in Europe. The basic principles have been known for more than a century. What is needed now is a concerted effort to develop the materials and processes required."

J. D. Merry

Materials Engineer, Engineering Services Dept., Carrier Corp., Syracuse, N.Y.

"Even though the industry has reason to point with pride at past advances in electrical insulation which have improved performance, increased reliability, reduced size, and decreased the cost of electrical devices as well as made possible the development of new devices, the fact remains that the weakest apparent member of almost any electrical device is still the insulation system. Therefore, I believe the greatest challenge to the insulation industry lies within the area of upgrading insulation systems to a point where they approach the predictable performance reliability of other components, such as the conductors, in an electrical device and where the device failures will not primarily involve insulation failures.

"An important milestone in accomplishing this ultimate goal will be the development of insulation systems with unqualified intrinsic resistance to thermal overload breakdown.

"Another aspect of this basic challenge is the need to develop more practical insulation systems than are presently available for continuous service under the much higher temperature requirements evolving from our entrance into the 'space age.' There does seem to be a good trend towards substantial progress in this particular area, and such advances as increased standardization of materials, improved quality control methods, and more meaningful accelerated aging tests will greatly aid in meeting this over-all challenge."

R. C. Straka, Jr.

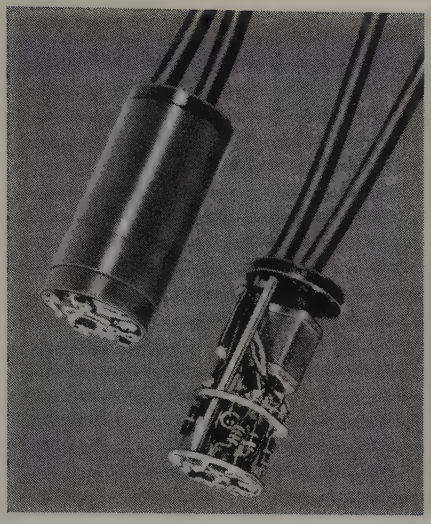
Manager, Ceramic Fiber Plant, The Carborundum Co., Niagara Falls, N.Y.

"High temperature fuel cells and other power sources, such as nuclear powered thermionic generators, will demand materials that are not now in production. Non-metallic semi-conductors and reliable miniaturized electronic systems, capable of operating in radiation and high temperature environments, will also present a challenge to this industry.

"We will meet such challenges by increasing our R & D efforts on the basic molecular structure and properties of inorganic materials. The resulting flexible ceramics effective at tem-

EXCESSIVE HEAT BUILD-UP

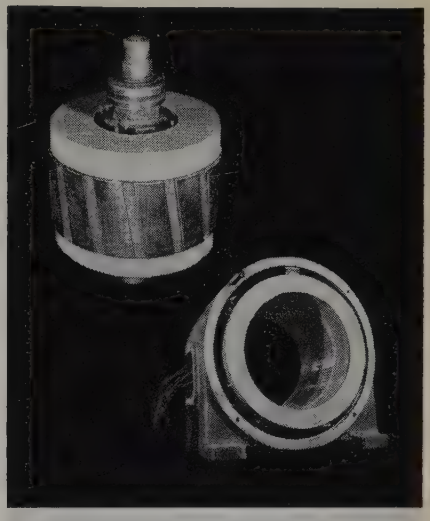
Conventional insulation on a huge stator (below) for a 2500 H.P. motor suffered severe degradation due to oil and particle build up. Result: excessive heat. Now reinsulated with glass cloth and compounds based on BAKELITE epoxy resins, heat-trapping air pockets and capillary defects are eliminated, and trouble-free service is ensured.



SEVERE MECHANICAL SHOCK

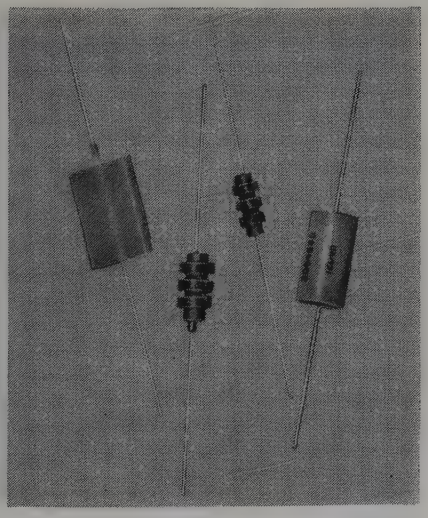
Head-set adaptors (left) for U.S. Air Force earphones require a covering which can withstand plenty of rough handling. Encapsulating with a compound based on tough BAKELITE epoxy resins provides shock-proof performance plus extra-low shrinkage to ensure complete and lasting adhesion to the delicate parts in the adaptor.

The toughest insulating problems are solved with BAKELITE® Epoxies



TEMPERATURE EXTREMES

At the nation's first line of defense—the Arctic "Dew Line" (Defense Early Warning)—insulating compounds based on BAKELITE epoxy resins keep inductors for military radar and electronic computers performing perfectly despite severe temperature and atmospheric conditions.



CORROSIVE CONTAMINANTS

Equipment in meat processing plants must be washed down frequently with germ-killing caustic or live steam; conventionally protected motors require constant repair under such extremes. Because compounds based on BAKELITE epoxies offer superb chemical resistance, they protect motor parts, like this encapsulated stator and rotor (above), from severe environmental conditions.

We'll gladly send you more information on performance-improving BAKELITE epoxy resins for electrical insulation. Write Dept. KW-75K, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE PLASTICS

peratures far above our present ultra-high (500°C) designation will be the building blocks on which many new electrical/electronic products will be based."

V. F. Steuer

Manufacturing Research Engineer, Electrodata Div., Burroughs Corp., Pasadena, Calif.

"The coming decade will be far more demanding in the field of electrical/electronic insulation than the past.

"Despite the fact that insulating materials have increasingly become the subject of serious study in recent years, the R & D work in dielectrics is far from being finalized.

"The remarkable—we may even say fantastic—growth in the electronics field with its expansion into space requires the combined efforts of physics, chemistry, and engineering to explore the composite nature of dielectrics.

"To transform the results of this R & D work into hardware, and produce the required dielectrics, will be the challenge of the coming decade for the electrical/electronic insulation industry."

E. C. Lowe

Materials Engineer, Lear Inc., Grand Rapids, Mich.

"The electrical/electronic insulation industry must not only continue to develop new and better materials during the next decade. It must concentrate extensively on the classification and dissemination of data for these materials.

"Developments in the organic-inorganic fields concerning higher temperature materials are extremely important and challenging. The development of other new materials, better evaluation techniques, test equipment, and the expansion and improvement of properties tested are also important.

"Along with all of these new developments, however, the selection and use of materials becomes more complex for the engineer. This problem should be of grave concern to everyone and its solution very important and challenging. Better methods of classifying, filing, and selecting of all materials will be necessary in the next decade to compensate for the increasing complications.

"New equipment and methods, including microfilming and photocopying, may necessarily become a requirement of the materials engineering staff of the future. These methods and equipment should also aid in decreasing the voluminous amount of paperwork and also lend support to the reporting and recording of new properties which will be necessary in the future for all materials."

Matthew Katz

Manager, Tantalum Capacitor Dept., Astron Corp., East Newark, N.J.

"Insulation is defined as something which sets apart, isolates. We generally use this word to mean electrical insulation. Electrical assemblies, however, also need physical insulation from their environment. The challenge to the insulation industry will be to provide both of these insulation functions in one material.

"The trends towards miniaturization, microminiaturization, and molecular circuits present increasingly severe environmental requirements. The usual glass-to-metal hermetic seals are being discarded as space wasters. In their place we find greater use of plastic encapsulating materials. Suppliers of these materials are being asked for better physical properties without degrading the electrical properties. The most important physical properties required are moisture resistance, thermal conductivity (for potted circuits), resistance to thermal and mechanical shock, and adhesion to the substrate. Of course, not all of these requirements may be specified for the same material at the same time.

"As a result, plastic materials will have to provide the same protection afforded by glass-to-metal seals. In this area, the two key requirements are a high level of moisture resistance in thin-walled sections and excellent adhesion of the encapsulant to the leads which emerge from the potted circuit.

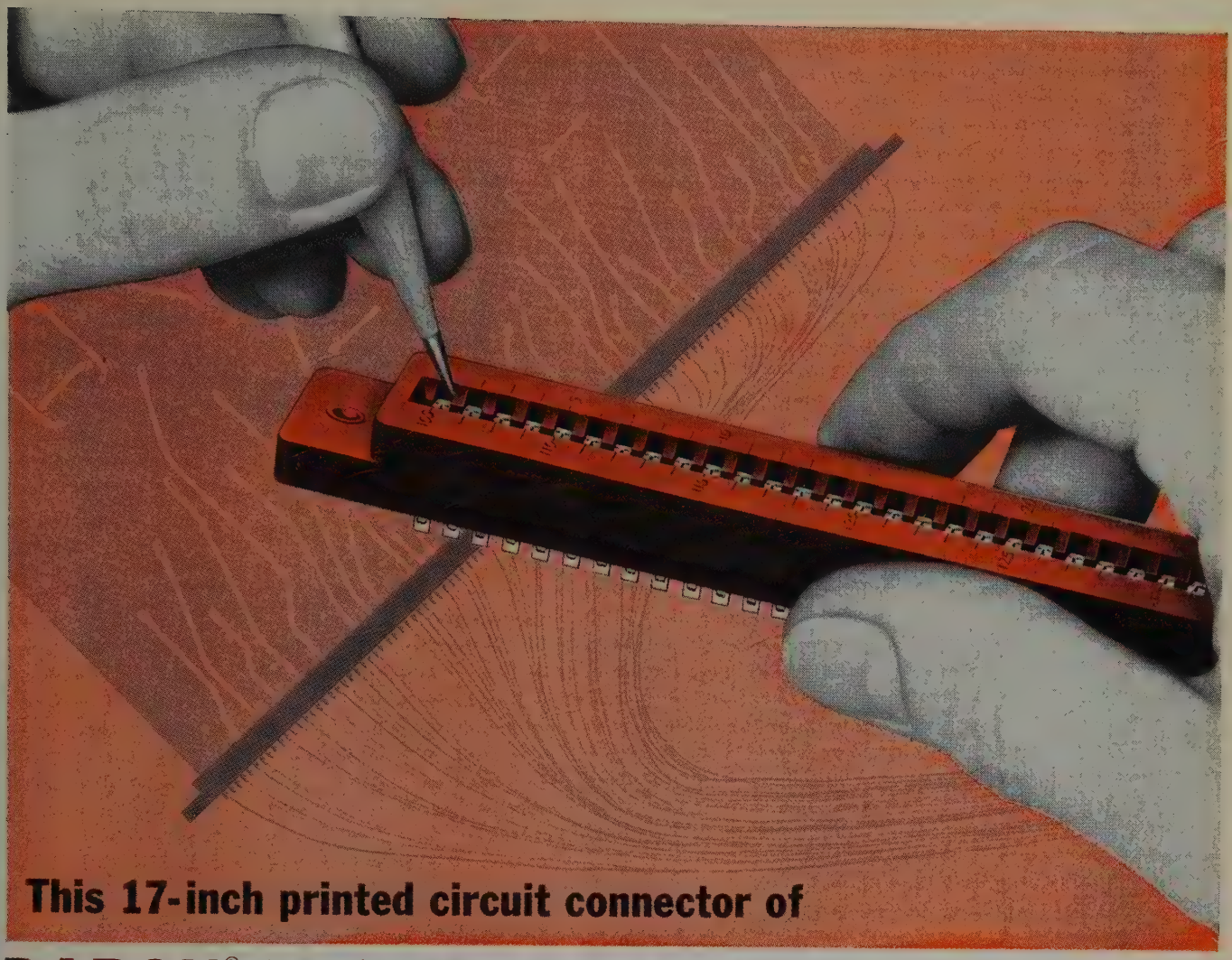
"Unless both of these requirements are simultaneously satisfied, hermetic sealing by plastic materials will not be possible. The future course of electronic miniaturization will follow the development of materials in which the properties of electrical and physical insulation are combined."

William H. Lane

Senior Engineer, Switchgear Dept., Allis-Chalmers Mfg. Co., Milwaukee, Wisc.

"The continuing goal of manufacturers of electric power equipment, i.e., motors, generators, transformers, switchgear, regulators, etc., is to develop equipment which has more power-handling capabilities but which takes up less physical space. The ability to successfully accomplish this depends to a great extent upon the development of new insulation materials by the insulation manufacturers. Constant insulation material research to develop materials with outstanding characteristics is an industry requirement.

"As soon as better insulation systems are available, more efficient equipment, operating at higher temperatures, will utilize these systems. There will be a continuing need for insulations which will sustain high operating temperatures for many years with no loss of their important physical and electrical properties: impact strength, flexural and compres-



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- top electrical qualities are a must
- better strengths are desired
- molding conditions pose a problem.

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sive strength, dielectric strength, insulation power factor, and resistance to tracking."

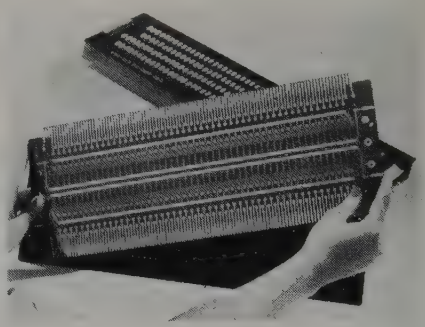
Improved Circuit Boards

Capacity reportedly is measured 10 times more accurately than before with new capacitor test and storage circuit boards developed by Corning Electronic Components. The boards are used in the reliability research and development program for the Minuteman missile guidance and control systems.

A fiber glass-epoxy board with a two-terminal wiring design was used originally. Meaningful measurements were prevented by stray capacitance and variable insulation resistance that often masked capacitor IR.

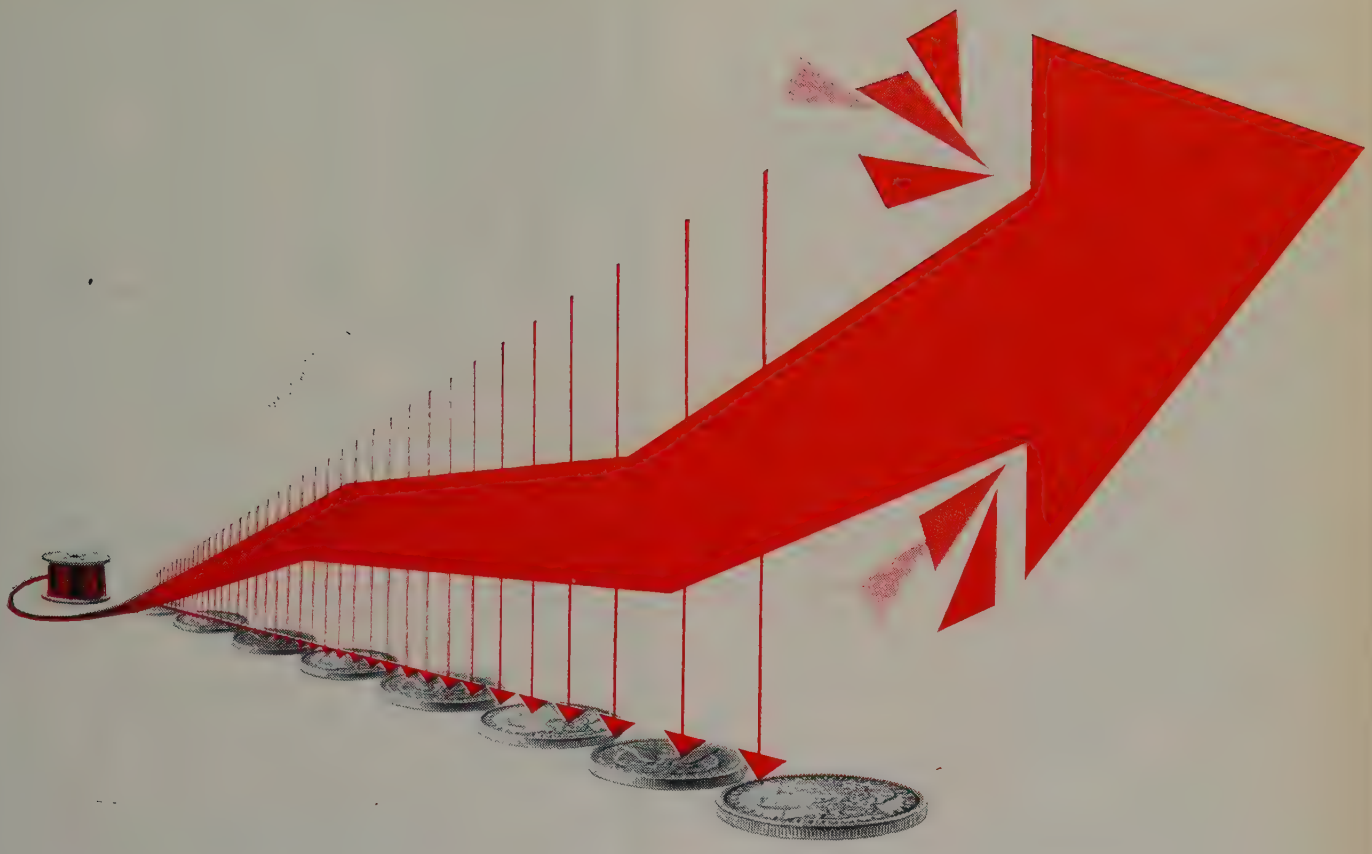
Then engineers worked out a three-terminal shielded circuit design utilizing "Fotoceram" glass-ceramic. Besides the 10-to-1 improvement in capacity measuring accuracy, the combination allowed meaningful measurements down nearly to the level of capacitor IR and .05 percent of dissipation factor.

An unmetallized upper board in each circuit board assembly carries 200 fusion-sealed capacitors. Leads extend through it to a lower board, which carries the circuit pattern. The



assembly allows rapid and repetitive measurements, convenient identification of capacitors—which are inventoried individually throughout their life—and efficient handling and shipping.

After testing, the lower boards are removed and returned to Corning for re-use. The capacitors are stored on the top boards until installed in the missile systems.



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Corona Resistant "Teflon" for High Voltage

By W. L. Gore, W. L. Gore & Associates, Inc., Newark, Del.

Although "Teflon" polytetrafluoroethylene is very nearly the ultimate dielectric material in most respects, it is only average in resistance to penetration by corona.

Corona is a stream of charged particles (ions and electrons) accelerated by an electric field. It is generated whenever a space filled with gas is subjected to a sufficiently high voltage stress to set up the cascading chain-reaction of high-velocity ions colliding with neutral molecules and generating additional ions which in turn collide to form still more ions.

Open cavities are present in all insulated structures, usually at the interface of the conductor and insulation. When corona is initiated in such a cavity, the ions impinge against the insulation. The repeated impacts penetrate into and through the insulation at a rate which depends on the force and frequency of the impacts and on the resistance of the insulation to the ion impacts. Many dielectric materials (such as polyethylene, polypropylene, polyamides, polytetrafluoroethylene, and polychlorotrifluoroethylene) are penetrated so rapidly that the insulation must be designed to reduce voltage gradients below the corona initiation level.

However corona may be started by a high voltage transient in a circuit caused by the closing of a relay or by resonant surge inherent in the circuit. Once initiated, only a relatively low voltage stress is needed to maintain the corona. Typical corona initiation levels range from 100 to 300 volts per mil while extinction levels may be half this range. Therefore, corona attack and consequent insulation failure may be more common than is generally recognized.

Teflon polytetrafluoroethylene resin insulations are now available[1] which contain an additive dispersed in the resin which reacts under the impingement of corona to form a liquid. This liquid covers the walls of any cavity with a film that absorbs the ion impacts and protects the solid dielectric from penetration. The protection is essentially complete if the impact energy of the ions is below the level required to penetrate the liquid film and strike into the solid dielectric beneath. Even at high energy impact levels, the liquid film absorbs much of the impact and greatly reduces the penetration rate through the insulation.

Design Factors for High Voltage

In addition to providing an additional measure of reliability, the availability of a corona resistant Teflon makes feasible the design of high-voltage cables that will operate over the temperature range from absolute zero to over 300°C, in corrosive environments, and under mechanical strain where other insulations eventually crack.

Before discussing specific design factors, it will be helpful to give a more quantitative description of the gaseous systems where corona occurs. The collision frequency of molecules is very high. Taking oxygen as an example, each molecule undergoes over 4-billion collisions per second at atmospheric pressure and 20°C, dropping to about 60-million per second at 10 mm Hg pressure. The average velocity of O_2 molecules is about 4.4×10^4 cm/sec (1000 miles/hr) at 20°C. The mean free path between collisions is about 10^{-5} cm (.000004") at atmospheric conditions and 7.5×10^{-3} cm (.003") at 10 mm Hg pressure. The acceleration of oxygen ions is about 2.6×10^{15} cm/sec^2 in a field of 100 volts/mil. The average velocity reached between collisions under this acceleration is 3.2×10^5 cm/sec at one atmosphere, and 2.6×10^6 at 10 mm Hg pressure.

The picture that emerges is one where collision frequency and mean free path are important factors in the generation rate of an ion cascade and in the rate of progression of the ions across the cavity. It is only when the ion velocities along the direction of the field exceed the thermal velocities by a large factor (perhaps at least by 10-fold) that enough directional impact of ions is gained against the walls of the cavity to cause significant penetration of the dielectric. It seems plausible that an ion cascade starts with a single ion and multiplies by a geometric progression at each collision of a high voltage ion with an inert molecule. The progress of the ions across the cavity is greatly inhibited by the scattering effects of collisions.

Some of the factors involved in the design of CR Teflon constructions can now be discussed in semi-quantitative fashion.

1—Voltage Stress

The life of any insulation subjected to corona is less than infinite, and as the voltage gradient increases, the life becomes shorter in accordance with what appears to be an exponential function. This is represented in figure 1. Typical test data is shown in figure 2. The major effect of the corona resisting additive is at intermediate voltage stresses where the liquid film is essentially impervious to the ion impacts.

It should be recognized, however, that the momentum of an ion at impact is related not only to its charge, mass, magnitude of the voltage gradient, and duration of voltage application, but also to the free path between collisions. Because of the variability in free path there will be a wide range of impact momentums, and even at lower voltage-gradients a small fraction of the ions may have enough momentum to penetrate through the protective film formed with CR Teflon. Despite this, most of the impact energy is absorbed by the liquid film so that very little penetration into the solid dielectric occurs.

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[1] *Supplied by W. L. Gore & Associates, Inc., 555 Paper Mill Rd., Newark, Del. "Teflon" is a Du Pont trademark.*

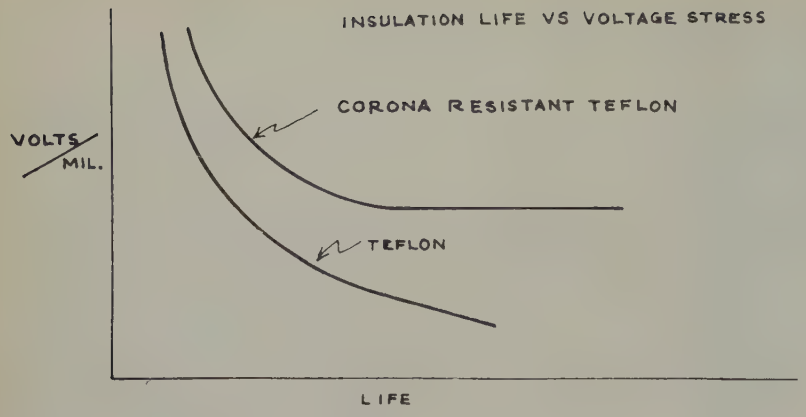

Figure 1, insulation life vs voltage stress.

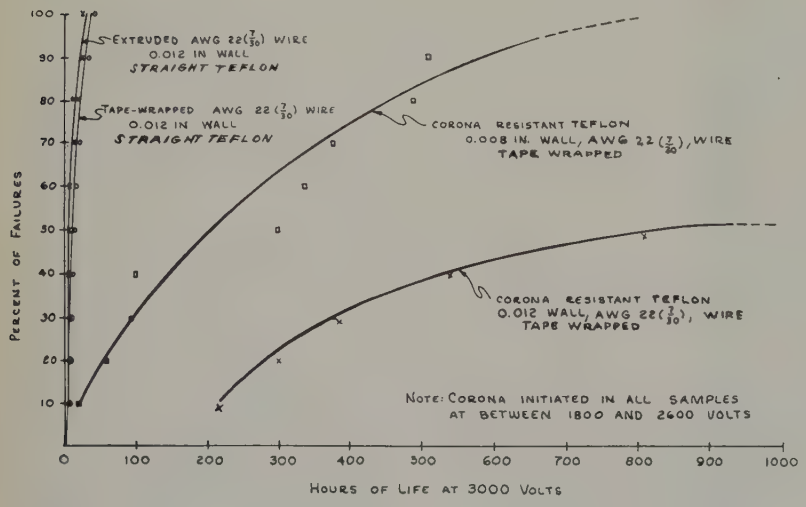

Figure 2, corona life at 3000 volt stress for corona resistant Teflon vs straight Teflon (samples immersed in aerosol solution).

2—Atmospheric Pressure (Altitude)

Cables with stranded conductors operate as an open tube, equalizing the pressure inside and outside the insulation. It is difficult to seal the ends of the cable so this pressure equalization will not occur over an extended time period. Therefore, when insulated conductors are used at high altitude or in outer space, the gas pressure in the micro-cavities becomes quite low. This increases the mean free path of an accelerated ion so that the impact momentum is increased.

Two opposing mechanisms appear to operate on the ion propagation rate, however. At higher pressures the molecular concentration is great, so that collisions are frequent and seldom does an ion achieve enough velocity to generate more ions on impact. As the pressure is reduced, the collisions become less frequent but more energetic. Finally, at very low pressures, the molecules become so rare that collisions, though energetic, are infrequent and ion propagation is low.

The factors of ion propagation and impact momentum combine to make the corona initiation voltage lowest and penetration rate highest when the pressure is at about 10 mm Hg, equivalent to 70,000-80,000 feet altitude. In high vacuum, corona is negligible

Table 1—Design Information for High-Voltage CR Constructions
Minimum Life Expectancy 10,000 Hrs.

Insulation Thickness	Gore Code	A-C Voltage Ratings		D-C Voltage Ratings	
		Sea Level	80,000 ft.	Sea Level	80,000 ft.
.025″	X2.5 CR	3,750	2,500	12,500	8,500
.030″	X3.0 CR	4,500	3,000	15,000	10,000
.035″	X3.5 CR	5,250	3,500	17,500	11,500
.040″	X4.0 CR	6,000	4,000	20,000	13,500
.050″	X5.0 CR	7,500	4,500	25,000	15,000
.065″	X6.5 CR	10,000	6,000	32,500	19,500
.080″	X8.0 CR	12,000	7,500	40,000	24,000
.100″	X10 CR	15,000	10,000	50,000	33,500

or absent. Figure 3 summarizes these effects.

3—Frequency

The total velocity of an ion due to the acceleration force on its charge in an electric field is determined by four factors:

1. The duration of the electric field in one direction.
2. The magnitude of the electric field, (voltage gradient).
3. The frequency of collisions between ions and molecules.
4. The mean free path between collisions (or across microcavities)

The effects of factors 3 and 4 are greatly changed at low pressures, while factor 1 is controlled by the frequency and wave-form of the electric field.

Successive collisions generate a certain fraction of very high velocity ions, since the rest of the ions dissipate their velocity by scattering their directions of rebound away from that of the field. The very high-speed ions are especially effective in penetrating the insulation and shorting out the circuit. Therefore an electric field must continue long enough to develop these high-speed ions before serious attack on the insulation can occur. On the other hand, if the duration of the field is too long, most of the ions will migrate out of the gas in the microcavity and there will be too few ions left to generate new cascades.

The effect of these two offsetting factors is to maximize the penetration of the insulation at frequencies in the range of 60-1000 cycles/sec. At high frequency, the cascade does not carry far enough to produce many high-speed ions. With d-c or uni-directional fields, ion propagation is limited by lack of ions to initiate the cascades. This relationship is shown in figure 4.

4—Environment

Variations in ambient temperature over a wide range (eg. —60°C to 300°C) appear to have no significant effect on the life of CR Teflon insulation under corona, although the corona initiation voltage is somewhat lower at high temperature. Moisture and a wide range of solvents and chemicals likewise show no measurable effect. Cables insulated with Teflon are unique in their resistance to failure under mechanical stress. This is a critical characteristic, since other insulations will crack after a period of time if the cable is first bent sharply and then subjected to corona. CR Teflon cables have never shown a stress-crack failure, even under very severe combinations of mechanical strain and corona.

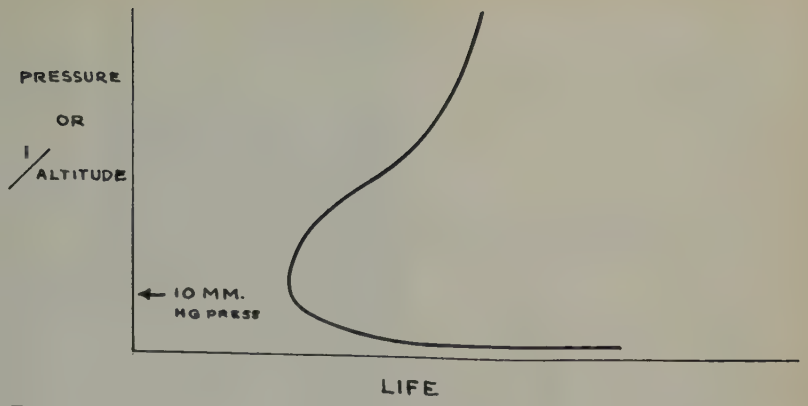

Figure 3, insulation life vs pressure.

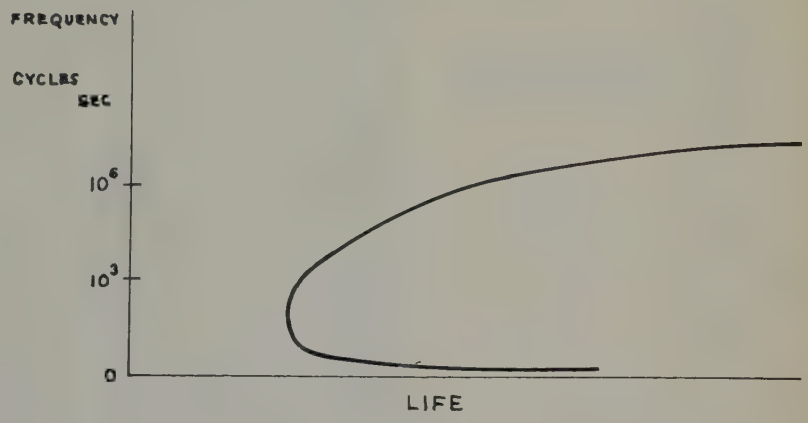

Figure 4, insulation life vs frequency.

Design Summary

Experience in varied applications and statistical evaluations of extensive data have developed a reliable basis for the design of high-voltage cables insulated with corona-resistant Teflon compound. A summary of standard insulated cables is given in table 1. The 10,000 hours minimum life at the rated voltages is quite conservative and reflects the concept that there will be an eventual penetration of any insulation if corona is present. Also the ratings were made on the assumption that not more than .005" of insulation will be removed by abrasion, cuts, or plastic deformation. High frequency designs will usually be similar to d-c but interacting effects of voltage, mean free path of ions, and wave-form must be considered.

Adjustment for service life shorter or longer than 10,000 hours is done on a logarithmic scale. For example, reducing the insulation thickness of table 5 to one-half the tabulated values will reduce the life to one-tenth (or to something greater than 1000 hours). Doubling the insulated thickness will increase the life at least 10 fold, and perhaps make it infinite. Insulation life is of course unlimited if the service conditions do not develop corona.

The corona resistant compound of polytetrafluoroethylene provides a new insulation for high voltage applications that brings the superlative dielectric, mechanical, and high-temperature properties of this material into a field until now denied to it by corona.

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Weight (1/32")	0.3 lbs./sq. ft.
(1/4")	2.3 lbs./sq. ft.
Specific Gravity	1.8
Density	110 lbs./cu. ft.
Flexural Strength (min.)	
1/16" as received	MD 40,000 psi CMD 25,000 psi
1/16" after 1 hr. @155 C	MD 24,000 psi CMD 15,000 psi
Tensile Strength (1/16")	MD 30,000 psi CMD 15,000 psi
Water Absorption	
1/8" after 24 hrs.	0.30%
Bond Strength	
as received	1210 lbs.
after 48 hrs. in distilled water @ 50 C	1055 lbs.
Standard Thicknesses	1/32", 1/16", 1/8", 1/4", 1/2"
Dielectric Strength Perpendicular	
1/16"	350 vpm
1/4"	200 vpm
Dielectric Strength Parallel	
as received	29KV
after 48 hrs. in distilled water @ 50 C	22KV
Dielectric Constant @ 10^6 cps	4.0
Dissipation Factor @ 10^6 cps	0.10
Arc Resistance	180 sec.

All tests conducted to NEMA and ASTM standards

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Program for Army-Industry Wire and Cable Symposium

The tenth annual Wire and Cable Symposium, jointly sponsored by the U. S. Army Signal Research and Development Laboratory and industry, will be held in the Berkeley-Carteret Hotel, Asbury Park, N.J., Nov. 29 through Dec. 1.

Howard F. X. Kingsley and Fred W. Wills, both of the Army Signal Research and Development Laboratory, are again serving as chairman and co-chairman, respectively. Other members of the symposium committee are: Ray Blain, U. S. Army Signal Engineering Agency; C. T. Wyman, Bell Telephone Laboratories; R. P. Houlihan, Gavitt Wire and Cable Co.; Spencer Montgomery Jr., The Montgomery Co.; W. P. Acton, Hercules Powder Co.; and R. L. Spade, Belden Manufacturing Co.

Program
10th Annual Wire & Cable Symposium
November 29—December 1, 1961
Hotel Berkeley-Carteret, Asbury Park, N.J.

Tuesday—November 28

4:00 pm—Registration

Wednesday—November 29

9:15 am—Welcoming Address: Changing Pattern of Telephone Outside Plant, by W. J. Lally, Bell Telephone Laboratories.

Technical Session I—S. Montgomery Jr., The Montgomery Co., chairman.

Chemically Cross-Linked Polyethylene, A General Purpose Compound, by Dr. T. H. Ling, Anaconda Wire & Cable Co.

Irradiated Light-Weight Miniature Coaxial Cable, by Dr. V. L. Lanza, Raychem Corp.

A New Concept In Semi-Solid Dielectric Coaxial Cable, by C. C. Camillo and O. A. Manella, R-F Products, Division of Amphenol-Borg Electronics Corp.

A New Approach to Compounding for High Temperature Vinyl Wire Insulation, by J. Fath and S. G. Grillo, Thompson Chemical Co.

2:00 pm—Technical Session II—C. T. Wyman, Bell Telephone Laboratories, chairman.

Long Span Insulated Open Wire Telephone Plant, by C. R. Ballard, H. Ericson, H. B. Lee, and G. A. Lohsl, Rural Electrification Administration, U. S. Department of Agriculture.

A Dual Insulated Terminating Cable, by G. H. Webster, Bell Telephone Laboratories.

Longitudinal Application of Insulation and Shields on Communication Cables, by H. W. Budenbender, Western Electric Co.

Cellular Insulation for Communication Cable, by B. B. Pusey, Union Carbide Plastics Co.

The Influence of Extruder Geometry in the Production of Homogeneous Cellular Plastic Insulation, by E. O. Bauer and P. E. Fox, Bell Telephone Laboratories.

Cellular Vinyl Wire Insulation, by R. M. Downing, J. H. Hook, and L. T. Staats, Jr., E. I. du Pont de Nemours & Co.

5:45 pm—Hospitality Hour

Thursday, November 30

9:15 am—Technical Session III—R. L. Spade, Belden Manufacturing Co., chairman.

Electrical Fatigue and Dielectric Strength in "Teflon" TFE Insulation, by D. E. Foster, R. T. Guthrie, and H. E. Pendergast, American Enka Corp.

Factors Influencing Accelerated Ozone Testing and Weathering of Cable Compositions, by W. J. Yurgen, S. Palinchak, and P. B. Stickney, Battelle Memorial Institute.

Water Absorption of Elastomers, by G. J. Briggs, D. C. Edwards, and E. B. Storey, Polymer Corp. of Canada.

The Properties of Esters of Trimellitic Anhydride in Vinyl Insulation, by R. J. Lawn, Pittsburgh Chemical Co.

Silicone Rubber Layer Construction for High Voltage Insulation, by S. J. Nizinski, Dow Corning Corp.

2:00 pm—Technical Session IV—Dr. W. P. Acton, Hercules Powder Co., chairman.

Standardization of Wire Terminations Employed in Military Equipments, by R. O. Beach and C. W. Wilson, American Machine & Foundry Co.

Wires and Cables for Submarine Radio Systems, by K. L. Blaisdell, U. S. Navy Underground Sound Laboratory.

A New Attenuating Conductor for Reducing Radio Frequency Noise Found on Ordinary Power Distribution Lines, by J. L. Brooks and D. B. Clark, U. S. Naval Civil Engineering Laboratory.

Underwater Cable Conductors and Terminations for Hydrostatic Pressures 1,000 to 10,000 PSI, by R. A. Swan and G. C. Thym, Joy Manufacturing Co.

The Quina: A Submarine Cable for Audio and Carrier Frequencies, by B. Portoletto and R. Monelli, Pirelli, SPA, Italy.

7:00 pm—Banquet

Friday, December 1

9:15 am—Technical Session V—R. P. Houlihan, Gavitt Wire & Cable Co., chairman.

Corrugated Metallic Sheath for Communication and Data Transmission Cable, by K. P. Roberts and P. H. Ware, Simplex Wire and Cable Co.

An Approach to Optimization of Missile Cable System Design, by W. Gilmore, Raytheon Manufacturing Co., and B. Kirshtein, Frankford Arsenal.

Development of Lightweight Ground Support Cables for Quick Reaction Missile Systems, by W. Rigling, The Martin Co.

Checkout Cables for An Air-to-Surface Missile, by F. K. Gill, Space & Information Systems Division, North American Aviation.

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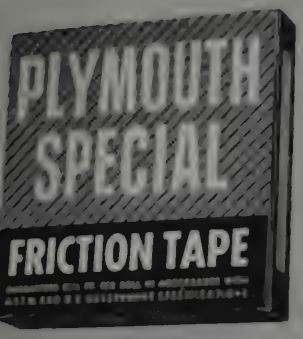

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Cross-Reinforcing Improves Strength Properties Of Non-Woven Glass Armature Banding Tapes

By Hollis H. Bascom, Coast Manufacturing and Supply Co., Livermore, Calif.

New armature banding materials consisting of non-woven fiber glass saturated with epoxy or polyester resin and consciously bi-directional (two cross threads per inch) markedly improve band performance.

Performance advantages of the "Vec-O-Tex" materials are two fold: improved specific stress levels and lower range of variation in specific values.

While the work reported here has just begun, we will risk some theorizations on the strength of the data so far collected. It should be borne in mind that this data is subject to further confirmation in the laboratory.

Armature banding with saturated fibers is, of course, merely a specialized use of the same filament winding techniques used for winding pressure bottles, rocket bodies, etc. Until recently, all armature banding was done with completely unidirectional materials. Some small attempt was made to add cross strength to the band. Individual lengths of tape (or wraps of conventionally woven fabric) were placed to prevent band splitting and spreading during the winding—and to help prevent circumferential cracking in the completely cured band.

Test Method

We selected the Naval Ordnance Laboratory hydraulic ring tensile test[1] as our test method for comparison of filament winding materials.

Principal reason for choosing this test was that we believed a radial loading method would stress test specimens in a manner similar to the type

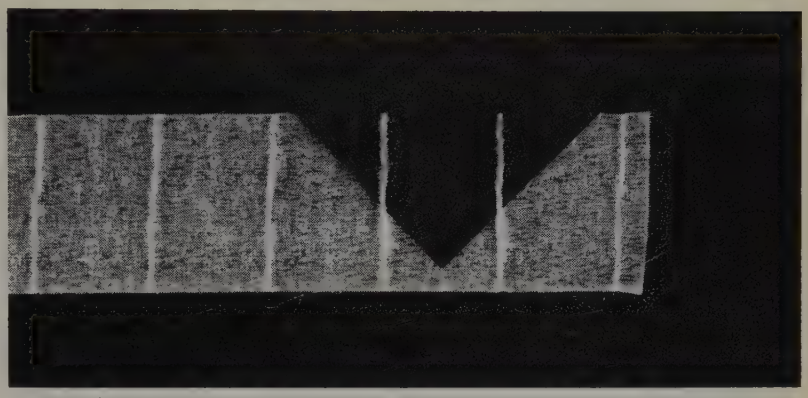


Figure 1, cross threads in reinforced banding tape.

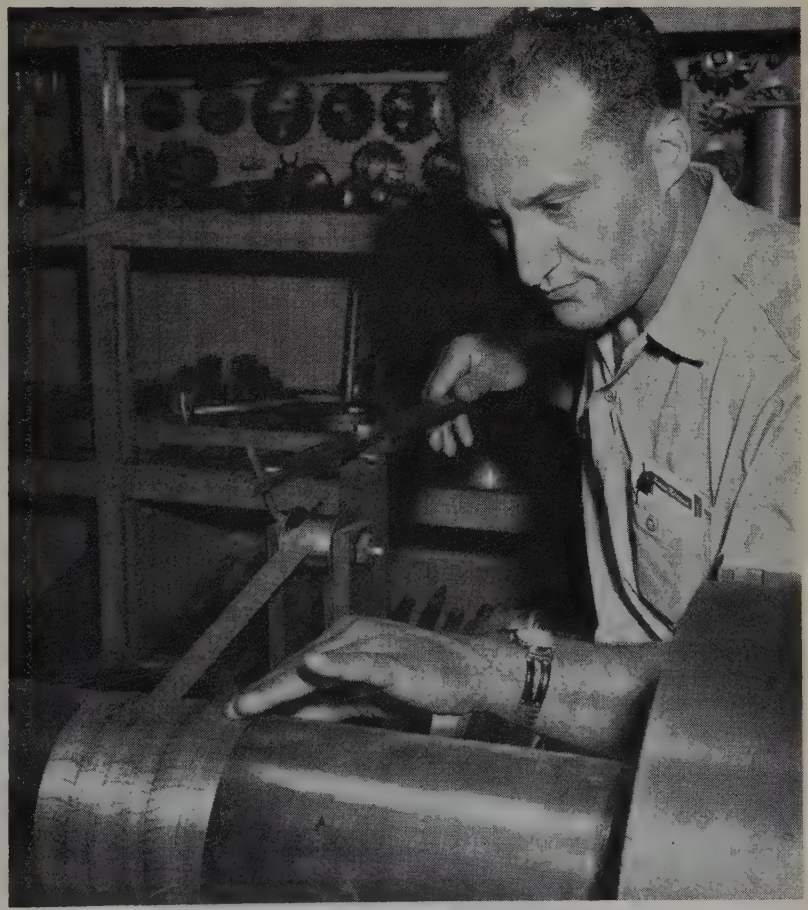


Figure 2, band winding. Cross threads are down against mandrel. Mandrel has been covered with "Mylar" for easy release after cure.

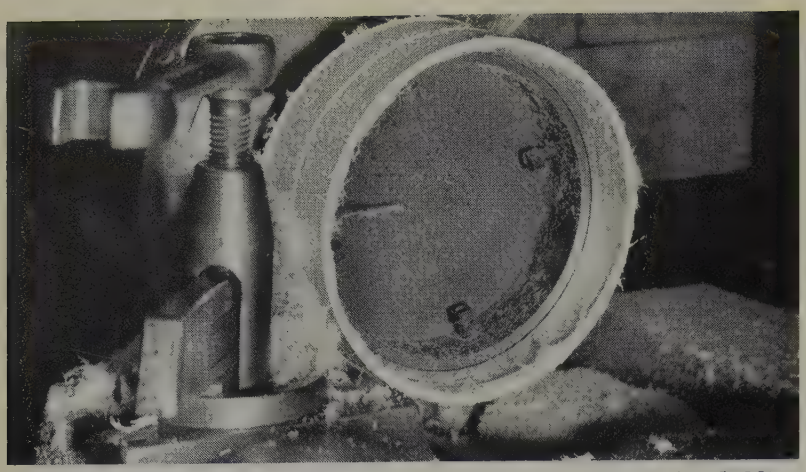


Figure 3, machining of rough band. Note special fixture for holding band.

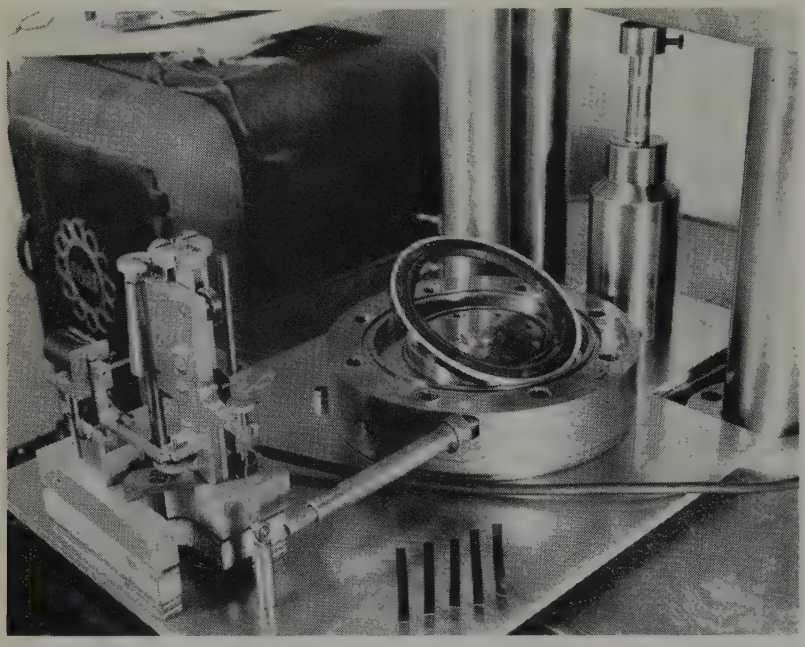


Figure 4, modified NOL hydraulic ring test fixture. Extensometer is in left foreground. Test fixture in center shows specimen with obturator ring in ID to contain hydraulic oil and steel strap around OD to measure ring growth. Upper right of picture shows hydraulic cylinder under cross head of universal test machine. Center foreground shows shims to be inserted between obturator ring and specimen.

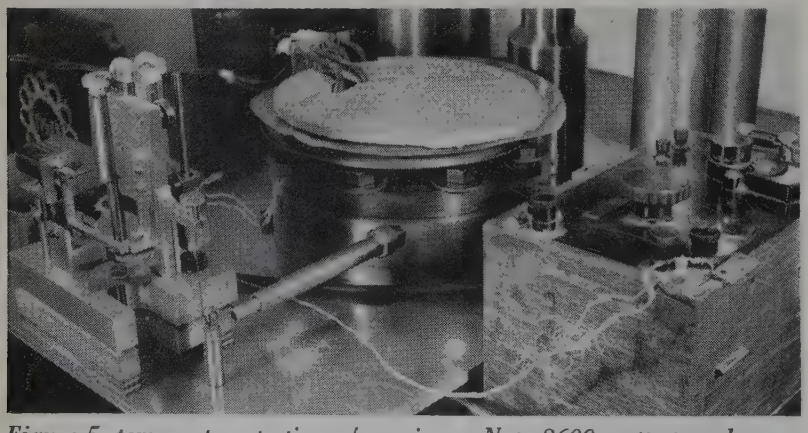


Figure 5, temperature testing of specimen. Note 2600 watt stove burner for heating and potentiometer for indicating specimen temperature in right foreground.

of loading encountered in actual use. Further, we felt that a radial loading test would be useful in that it would be applicable to all filament winding materials and would be essentially independent of the configuration of those filament-wound materials.

We were most interested in comparing unidirectional winding materials and also winding materials which were consciously bi-directional in reinforcement arrangement. We felt that while the split disc test was useful for sorting materials of the same general constructions, such as straight unidirectional materials, it might give erroneous data concerning uniquely constructed materials. A further advantage we hoped for from the hydraulic ring test was that the specific values might be more useful as design criteria.

The NOL hydraulic tester is an arrangement wherein a specimen 5¾ inches in ID and 6 inches in OD, with a ¼-inch width and an ⅛-inch thickness, is loaded at a constant rate with a hydraulic fluid to destruction. The fixture is so constructed that it is also possible to record stress-strain relationships.

Specimen Preparation

Test specimens were prepared by first placing a layer of polyester film[2] on a smooth steel tube which is 5¾ inches on the OD. Then a ⅜-inch width of banding material is wound under a tension of 500 pounds per inch width in a helical manner, half lapping along the mandrel. In this manner a rough band is produced which is approximately 3 to 4 inches wide and ¼-inch in thickness.

In winding the various filament winding materials available, heavy edge restraints were used at the outer edges of the band when winding with a completely unidirectional material. No edge restraints were used when winding with a consciously bi-directional material. In this initial work a comparison was made with a commercially available unidirectional band winding material and the bi-directional materials.

Machining and Curing

After the band preparation, test

pecimens were machined from the band. Tolerances were closely controlled. The specimen, when finally tested, was always of a given cross section rather than controlled to a given number of wraps of material.

To the best of our knowledge, the resin used in both of these filament winding materials was the same polyester (30% by weight) and the specimens in both cases were wound in a cold condition. That is, no heat was added either to the mandrel or to the tape.

While the tension was still on the tapes, the bands were terminated using the soldering iron technique. Then a layer of polyester film was placed over the band and adhesive-backed cellophane tape[3] was used to seal the free end of the film. The specimens were placed in an oven and heated for four hours at 150°C.

After this cure, and after the bands had cooled, they were pressed off the mandrel and machined to final dimensions. None of the inside surfaces of the specimens were machined—only the OD and the two edges. The surfaces were machined smoothly and finally finished by polishing with emery cloth.

Following the machining operation, it was interesting to note the grain structure of the reinforcement in the bands. The reinforcement in the completely unidirectional material had many marked crimps in it, while that in the consciously controlled bidirectional material was a great deal straighter and had none of the sharp crimps observed in the unidirectional material.

At this stage (after machining), the specimens were placed in the test fixture. The test fixture was mounted on a universal test machine in such a way that the cross head of the machine could load the hydraulic cylinder at a controlled rate—which was ½-inch per minute. The force exerted by the machine and the deformation noted in the total growth of the band were both recorded on a chart.

Conclusions

The data (see table 1) indicate a 59 percent increase in band strength

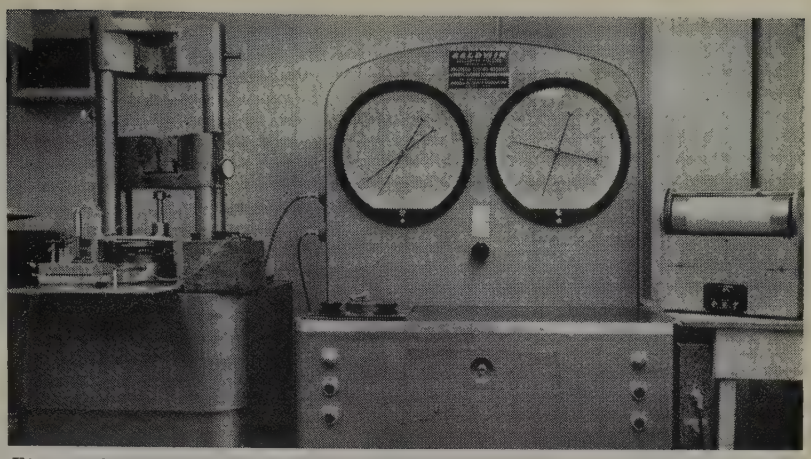


Figure 6, complete test setup. At right center is a recorder for plotting load vs. specimen growth from which tensile modulus is calculated.

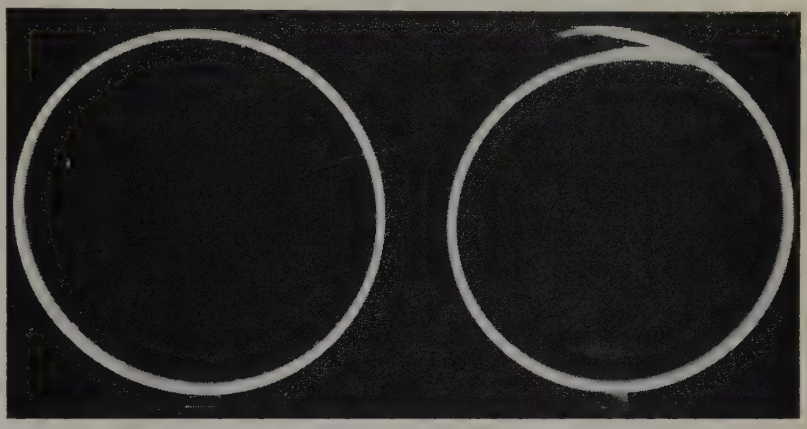


Figure 7, test specimen before and after break. Note that break occurs in weakest spot only.

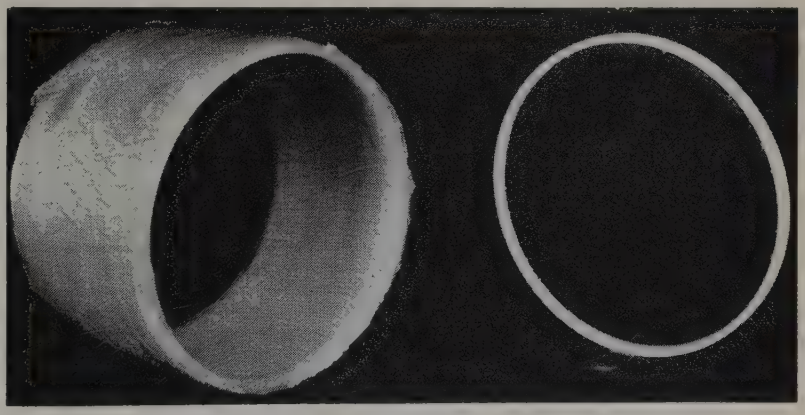


Figure 8, rough band before machining and finished specimen.

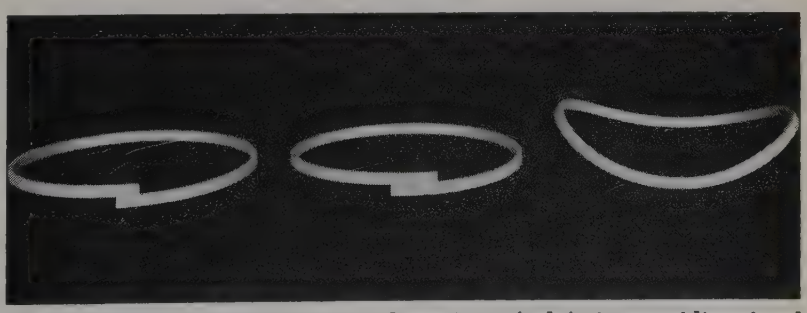


Figure 9, comparisons of retained tension. At left is a unidirectional product. Compare overlap with that of the bidirectional band in the center. On right note warping of post-cured bidirectional band showing that cross fibers prevented relieving of stress except by warping.

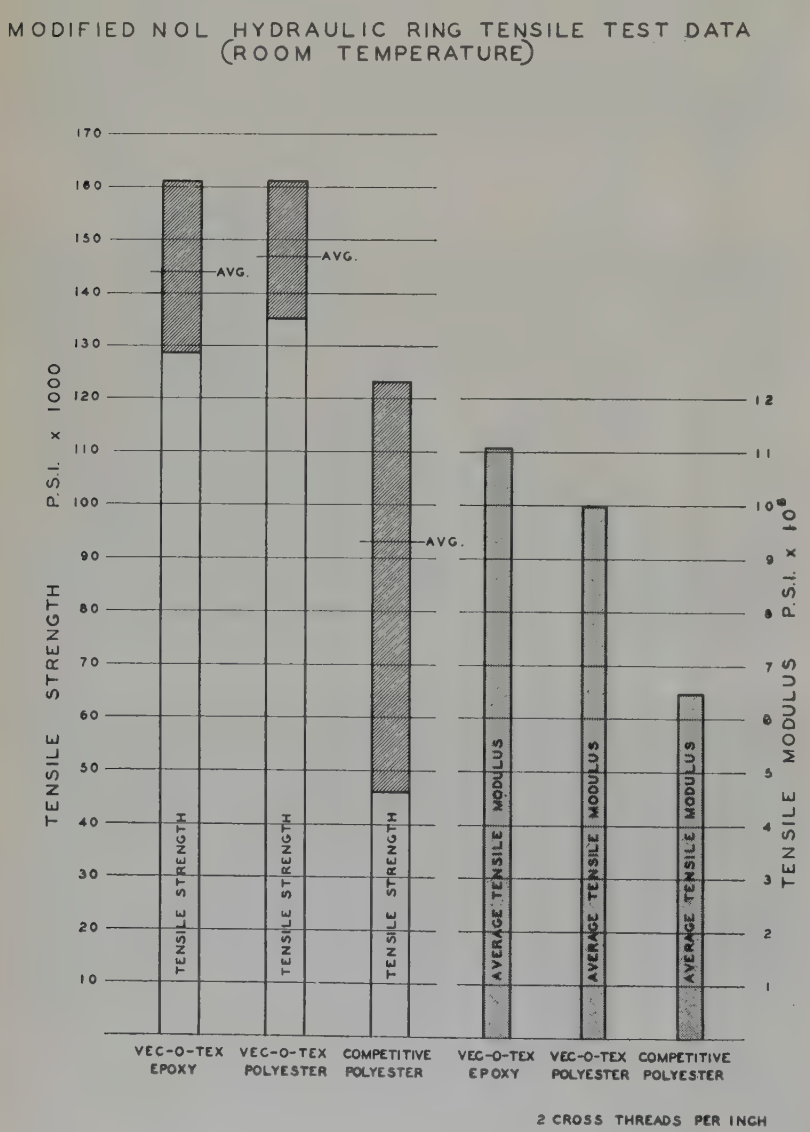
Table 1—Modified NOL Hydraulic Ring Tensile Test Data on Armature Banding Materials

	Total Burnoff	Tensile Strength: Average (PSI)	Tensile Strength: % Increase over Unidirectional	Tensile Strength: Range (PSI)	Tensile Modulus: Average (PSI)	Tensile Modulus: % Increase over Unidirectional
Bi-directional Polyester Ring (5 tests)	32.5%	147,000	59%	135,000 to 161,000	10.0×10^6	55%
Bi-directional Epoxy Ring (5 tests)	32.5%	144,000	54%	128,000 to 161,000	11.1×10^6	71%
Completely Unidirectional Polyester Ring (6 tests)	30.0%	93,000	—	46,000 to 123,000	6.5×10^6	—

NOTE: Room temperature results on bi-directional materials seem to be independent of resin system. Even when cold banding, the retained tension of bi-directional material is very high, and hence the coil movement is restricted a great deal more than with unidirectional tapes.

This data was collected under the following conditions:

A. Winding tension: 500 pounds per inch width.
B. Type of wind: Helical, half lap at room temperature.
C. Cure of ring: 4 hours at 150°C.
D. Post cure: None.
E. Fixture temperature: Room (70 to 75°F).
F. Ram speed: 0.50 inches per min.
G. Both load and deformation were recorded.
H. Specimen dimensions: 5¾ inches ID, 6 inches OD, 0.125 inch thick, 0.250 inch wide.
I. The test specimens were prepared as follows: They were wound on a 5¾ inch OD mandrel to a total thickness of approximately ¼ inch and a width of 4 inches. The test specimens were machined from these rough bands. The sides and OD only were machined to close tolerances.



of the bi-directional polyester material over that of the unidirectional polyester material. These are average values. Even if the three lowest values are ignored, the increase in strength is still 23½ percent. In the meantime, the tensile modulus is also improved by 55 percent.

In the epoxy bi-directional material the tensile strength is improved 54 percent, while the apparent tensile modulus is improved by 71 percent.

Visually distinguishable high-reinforcement distortion in bands were the places where early failures occurred. Some of the bands failed at less than one half the values that other bands failed.

These tests lend a great deal of further credence to the theory that maintenance of position of reinforcement in filament-wound structures is of primary importance. We believe that in the material which is consciously bi-directional and consciously designed, a structure is built up—a structure that is to a large extent independent of the resin system as far as strength function is concerned.

This may be illustrated by comparison with a bundle of model sticks. If a bundle of sticks is held in the hand with all of the sticks substantially parallel, and the sticks are then

dropped on a table, any pressure put on them will tend to flatten them into a thin layer. But if a row of sticks is placed on the table and then some very small fibers or other sticks are laid across them, and then another row laid on top of this, etc., it is possible to build a very stable structure to which considerable pressure can be applied—not only straight downward but downward and sideways—without moving the sticks in either direction.

We believe it is this type of mechanical action which accounts for the superior performance of the bands wound and tested in these experiments. Cold winding with this kind of material, even where it is desired to retain high pre-stresses, is entirely practical with this new kind of material.

Notes

We found in the laboratory, and also on an actual traction armature, that the particular bi-directional material with two cross threads per inch used in these experiments performs extremely well in the usually encountered shop practices of half lapping and uneven substrate.

We also learned during the winding of these specimens that when a bi-directional product which has eight cross strands per inch was used on a half lap helical wind, the integrity of the tape was so good that many times virtually all of the tension was picked up on the portion of the tape which was in contact with the preceding layer—with the result that the tape was over-stressed and broken. The tape used to prepare the previously discussed specimens conformed very well to the uneven substrate—with no tape breakage encountered.

While some of the tensile moduli are unreasonably high, we believe that they are good for comparisons even though they may well be questioned as design criteria.

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1. *Described in NAVORD Report 6735, dated 23 December 1959, and published in May, 1960.*
2. *"Mylar" film, E. I. du Pont de Nemours and Co. Inc.*
3. *"Scotch" brand tape, Minnesota Mining and Mfg. Co.*

A-C Anodization of Aluminum Wire in Sulfuric Acid Solutions

Part 1 — Pilot Plant Process

By Wm. H. Fischer and J. A. Consiglio, General Engineering Laboratory, General Electric Co., Schenectady, N.Y.

Ed. Note: Part 2 covering electrical properties of anodic films will appear next month.

Introduction

Recent developments in industry and defense have given rise to demands for high temperature electrical components. Among these are high temperature wire insulation such as aluminum oxide. An attractive production method involves anodizing the aluminum to form the oxide directly.

The anodization of aluminum in various electrolytes has been discussed extensively[1,2,3,4]. In general, two methods of anodization, a-c and d-c, and two types of electrolytes, those having a solvent action on the anodic film and those having no solvent action, are recognized. One of the major defects of older types of anodized aluminum wires has been the lack of film flexibility. On theoretical grounds, formation of the anodic film by alternating current in a solvent type electrolyte produces a porous film structure which should improve flexibility. The use of a solvent electrolyte has the additional advantage of achieving thicker films than is possible with a nonsolvent electrolyte using the same forming voltage.

Solvent electrolytes also permit the use of higher current densities, thus permitting shorter residence times. For these reasons we elected to use a-c current in a solvent-type electrolyte. The electrolyte used was 35 to 40 weight percent sulfuric acid. We observed no effects attributable to acid concentration within this range. Such a process is also being developed by workers at Aluminum Co. of Canada[5].

The objective of this article is to describe a pilot plant based upon this process as well as the effects of the major process variables upon some physical properties of the anodic film.

Experimental Facility

A schematic diagram of a pilot plant for the continuous strand anodizing of aluminum wire is shown in figure 1. Considering anodizing as a coating process, the need for surface preparation is apparent. Consequently, about one-half of the pilot plant is devoted to surface preparation. The surface preparation is a fairly normal one—annealing to remove stresses and cold work introduced in the wire drawing operations, alkali cleaning and water washing, and solvent degreasing to remove drawing compounds and adventitious soil.

Annealing is done in stagnant air in an electrically heated tube furnace.

A hot alkali cleaning solution is pumped over the wire as it passes through a glass T tube. A running cold water wash by means of a second T tube is used to remove the alkali. Most of the wire has been so clean that these two steps usually have been omitted.

The solvent degreaser is divided into three sections. In the first and third sections, the wire passes through refluxing vapors. In the second section, which is not heated, the wire passes through the warm liquid, lower in temperature than the end sections. The liquid is pumped into the second from the first and third sections and overflows back into them. Thus, the wire is given two vapor cleanings, separated by a combined cooling and liquid cleaning step. Trichlorethylene is used as the solvent.

Although we realize that grease on the wire which passes through the annealing furnace may not be removed by degreasing, annealing is done before degreasing because hot chlorinated solvents attack cold worked aluminum more than soft aluminum.[6,7,8,9]

From the surface preparation portion of the pilot plant, the wire passes

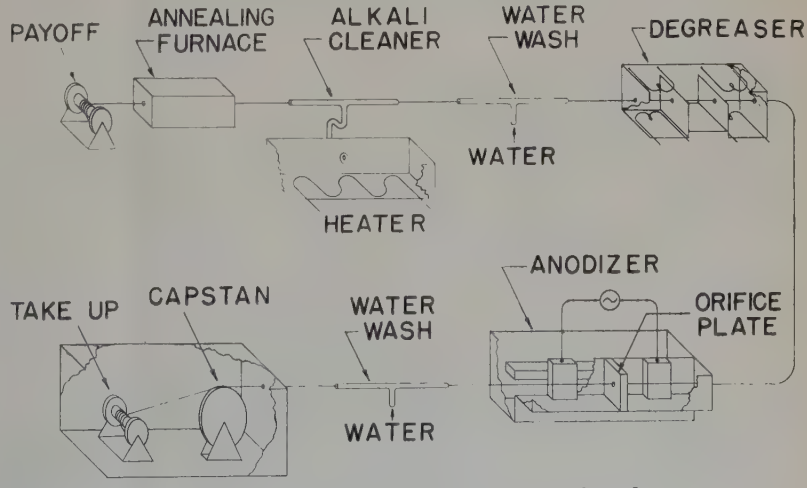

Figure 1, schematic of anodized aluminum wire pilot plant.

into the anodizing portion which is constructed of unplasticized polyvinyl chloride. The anodizing trough is divided into two sections of equal length by an orifice plate which has a hole only slightly larger than the wire. The trough is located over two sumps which contain graphite heat exchangers. Glycol solution circulates through the heat exchangers and a standard refrigeration unit. A pair of pumps moves the electrolyte from the sumps to the troughs, from which it overflows back to the sumps.

In each section of the anodizing trough a number of graphite sheet electrodes are placed. All the electrodes in one section are connected to one side of the a-c line, and all those in the other section to the other side of the a-c line. There is no metallic electrical contact to the wire. The only connection between the two sections of the trough is via the electrolyte and wire in the small orifice. Thus, on one half cycle of the electric current, an anodic film is forming in one section of the trough as the current passes from the wire through the electrolyte to the electrodes. In the other section, the anodic film partially chemically dissolves as the current flows from the electrodes through the electrolyte to the wire. As the current flow reverses, the location of anodization and dissolution also reverses. Fortunately, the dissolution rate is less than the anodization rate, so that the emerging wire bears an anodic film.

All of the anodizing system is contained in a plastic fume removal system to remove gases formed during the anodizing process.

After anodization, the wire is given two running water washes and spooled by a constant speed capstan-type winder.

The pilot plant is operated from a central control board provided with several interlock systems to prevent injury to the operator or the plant.

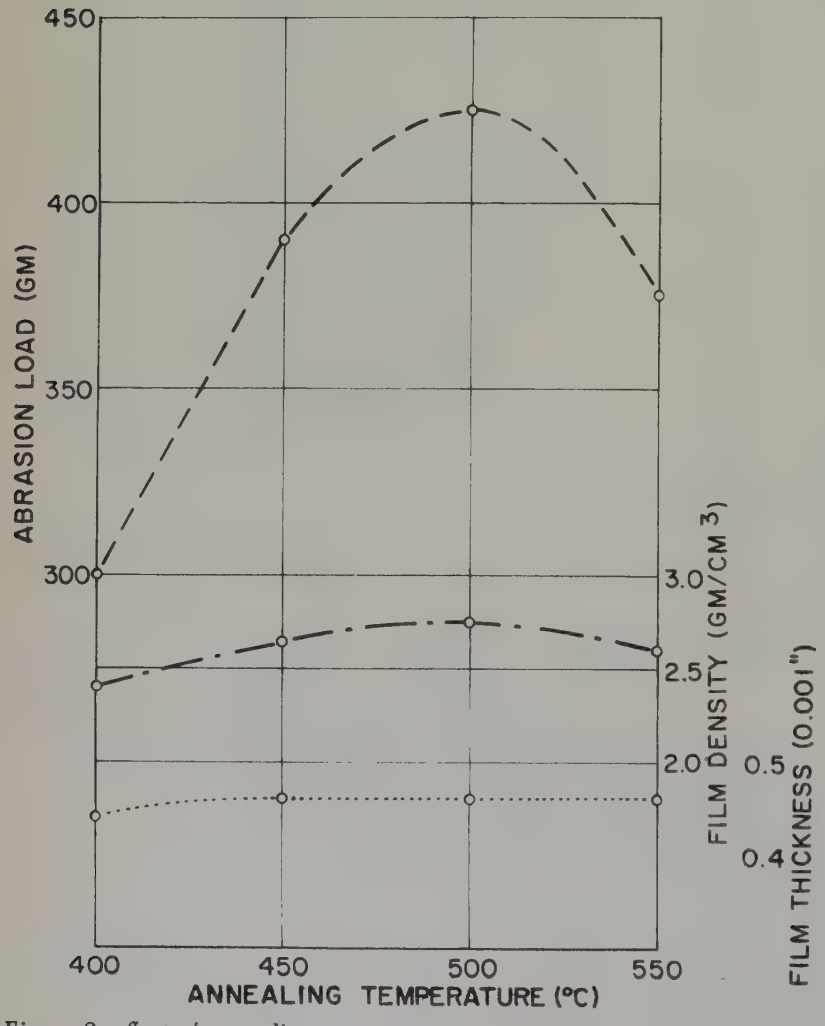

Figure 2, effect of annealing temperature on single scrape abrasion load (— — —), film density (— · —), and film thickness (· · ·). Samples not degreased, electrolyte temperature 10°C, residence time 90 seconds, current density 2 amperes per square inch.

Film Evaluation

The physical tests employed are: (1) Single scrape abrasion resistance, using a tester which measures the load required to scrape through the anodic film in a distance of not more than 3/8-inch. We believe that this method of determining the abrasion resistance of a wire insulation is better than the usual ASTM or NEMA repeated scrape abrasion resistance test in that the single scrape test more nearly simulates what the wire must withstand during the fabrication of electrical equipment. (2) Thickness. (3) Apparent density of the anodic film by micrometer measurements and weighings before and after stripping of the film in a phosphoric-chromic acid solution.

Process Variables

The process variables evaluated are (1) annealing temperature, (2) electrolyte temperature, (3) residence time, and (4) current density.

Annealing temperature was varied from 400 to 550°C in 50° steps. Figure 2 shows its effect upon physical properties.

Film density and abrasion resistance show peaks at 500°C while our measuring method shows no detectable effect upon film thickness.

Electrolyte temperature was varied from 0 to 21°C in 5° steps. Figure 3 shows its effect upon physical properties.

Film density exhibits a minimum at 5°C; abrasion resistance shows a continual increase while film thickness is again but little affected.

Residence time was varied from 21 to 180 seconds. The results are tabulated in table 1. At residence times below about 60 seconds, no detectable anodic film is formed, while at greater residence times a film is formed whose abrasion resistance and film thickness increase while film density remains nearly constant. The effect on film

thickness is quite marked, in contrast to the negligible effect of annealing temperature and electrolyte temperature.

Apparent current density was varied from 1 to 3.5 amp/sq in. Figure 4 shows its effects upon physical properties.

Film thickness and abrasion resistance show maxima at 2 amp/sq in while film density continually decreases.

The current efficiencies for these current densities are given in table 2. Current efficiencies ranging from 25 to 65% have been observed. It must be remembered that this process employing a solvent-type electrolyte can never give current efficiencies as high as can be attained with non-solvent-type electrolytes.

Discussion

The data presented indicate that the best operating conditions are annealing at 500°C, electrolyte temperature of 15°C, as long a residence time as is compatible with getting a reasonable amount of product per unit time, and a current density of 2 amp/sq in. However, all these variables are not independent, and some of them cannot be changed without affecting others. The annealing step increases the thickness of the oxide film normally present on aluminum, which may have an effect on the final film properties. perhaps in the following manner.

As *annealing temperature* increases. the thermal oxide film on the aluminum increases, which acts as a prefabricated base for the chemical oxide film. If the alkali cleaner had been employed we would not have expected to observe this. At temperatures above 500°C, the thermal oxide film may be thick enough to crack, or the wire may become so soft that it necks down slightly, cracking the film. Either may cause thin spots in the final film which are reflected in the decrease in the results of the tests for single scrape abrasion load and density, but not in thickness, since these tests find the minimum value for abrasion, an average value for density, and more nearly the maximum value for thickness.

As *electrolyte temperature* increases, two processes are accelerated —film formation and solvent attack on the film. The solvent attack is concentrated in the pores of the film structure. [1,10] Consequently, the film first increases in thickness with little change in pore size, followed by an increase in thickness with increase in pore size which lowers the density. Finally, if equilibrium conditions are attained, the thickness stops increasing and we would expect the pore size increase to continue. Why the density

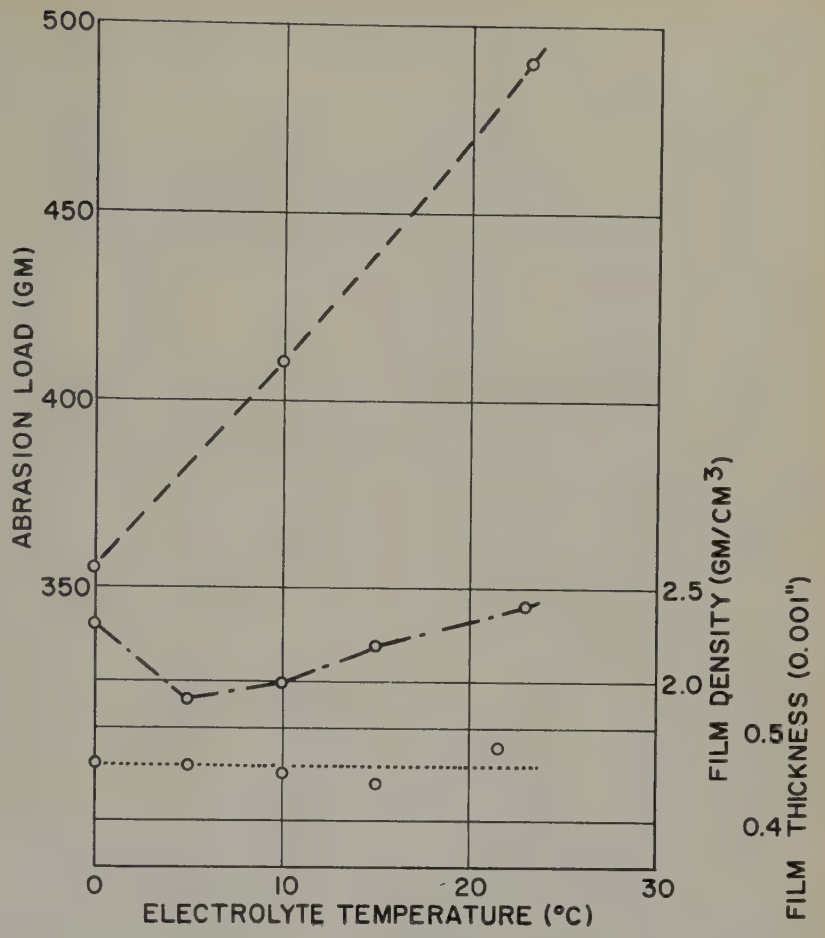

Figure 3, effect of electrolyte temperature on single scrape abrasion load (— — —), film density (— · —), and film thickness (· · ·). Samples annealed at 400°C, degreased, residence time 90 seconds, current density 2 amperes per square inch.

Table 1—Effect of Residence Time on Single Scrape Abrasion Resistance, Film Density and Film Thickness

Residence Time (sec.)	Abrasion Load (gm)	Film Density (gm/cm³)	Film Thickness (0.001")
90	350	2.40	0.46
180	420	2.35	0.74

Samples annealed at 400°C, not degreased, electrolyte temperature 10°C, current density 2 amp/sq in.

Table 2—Relationship Between Current Density and Current Efficiency

Current Density (amp/in²)	Current Efficiency (%)
1.4	39.8
2.0	58.4
2.5	43.7
3.5	25.3

Samples annealed at 500°C, degreased, electrolyte temperature 10°C, residence time 120 seconds.

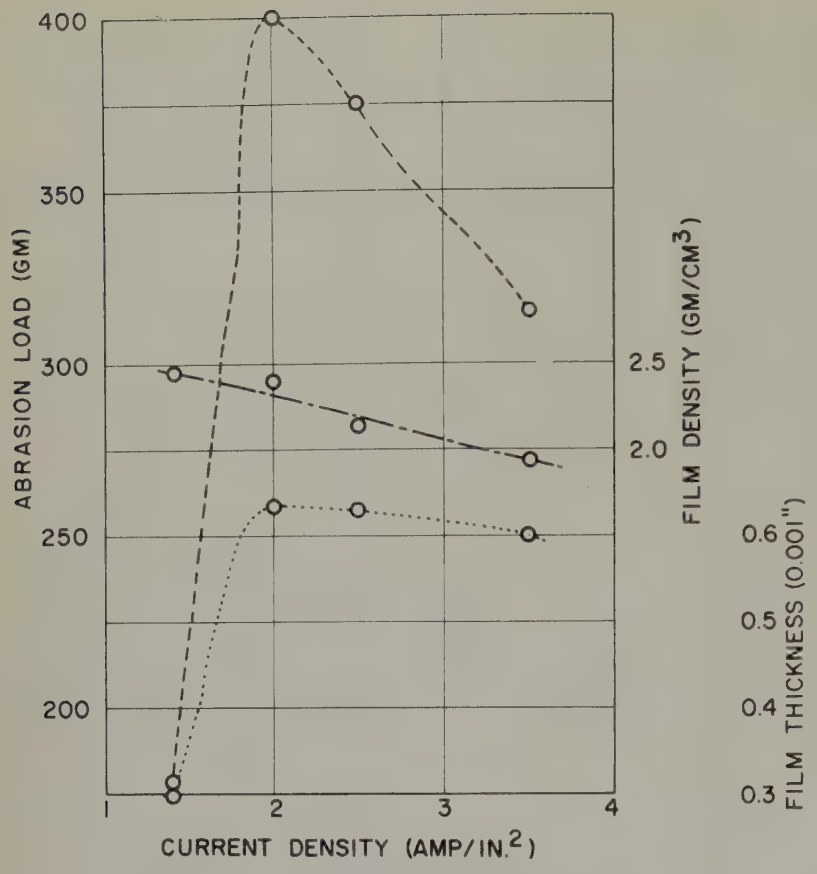

Figure 4, effect of current density on single scrape abrasion load (— — —), film density (— . —) and film thickness (. . .) Samples annealed at 500°C, degreased, electrolyte temperature 10°C, residence time 120 seconds.

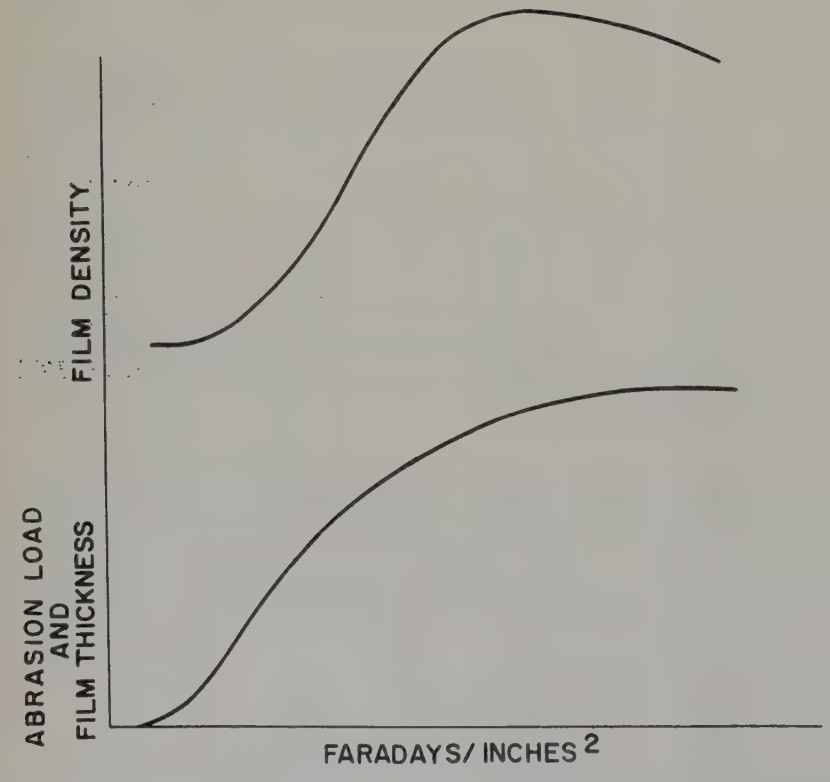

Figure 5, sketch of effect of product of current density and residence time (Faradays/inch²) on film density, single scrape abrasion load, and film thickness.

first decreases then increases, instead of the reverse or instead of constantly decreasing is not known.

The effects of *residence time* in the anodizing media are quite normal. Abrasion resistance and thickness increase and density decreases as residence time increases.

Current density effects are also normal. As current density increases, abrasion resistance reaches a maximum and then declines while thickness increases to a nearly constant value and density constantly decreases. This again is due to the combined effects of anodic film formation and solvent attack.

The primary process variables for any electrochemical process such as the anodization of aluminum are the current density and time. These govern the mass of aluminum oxide deposited per unit area according to Faraday's law and therefore the thickness of the film formed on the wire. However, for electrolytes such as sulfuric acid which tend to dissolve the anodic film, the resulting film thickness and density are also a function of the electrolyte temperature and the heat generated by current flow through the film as it is formed. In general, the higher the current and temperature, the higher is the dissolution rate of the anodic film by the electrolyte. These then tend to reduce the film thickness and density which in turn affect the electrical and mechanical properties.

As will be shown below, the thickness and density of the anodic film are functions of the combination of residence time and current density into a product which is related to Faradays per unit area. The functions are not linear since the final anodic film is the result of two simultaneous processes, electrochemical film formation and chemical film dissolution.

At low values of the parameter Faradays per unit area, all test results are low since the film is just beginning to form, and it probably does not begin to form at all points at the same time and rate.

At high values of the parameter there is an increase in all test results, followed by a decrease in thickness and more notably in density. The de-

rease in density occurs because high arameter values require high form-ng current, which can only be at-ained by impressing high voltages on ne anodizing media. But, at suffi-iently high voltages, arcing occurs at he wire surface which punctures the lm. These punctures immediately egin to reanodize, but they are al-vays thinner than the unpunctured lm, resulting in lowered apparent ensity.

Figure 5 shows in a qualitative nanner the way in which film prop-rties vary with Faradays per unit rea. As would be expected, single crape abrasion load at failure and ilm thickness increase to a limiting alue. The film density however, in-reases to a maximum and then de-lines, due to dissolution enlarging he pore structure of the anodic film s well as affecting its over-all thick-ess and the puncturing effect men-ioned previously.

The film thickness stabilizes because he high currents raise the tempera-ure of the wire surface which in-reases solvent attack until electro-chemical film formation and chemical film dissolution balance.

Single scrape abrasion load at failure acts similarly to film thickness, as it should, since the abrader must cut through the anodic film to the underlying metal in order to indicate failure.

Conclusion

The data presented here indicate that the continuous strand anodization of aluminum in sulfuric acid solutions is a process which can be easily controlled to give practical films. The effects of process variables of annealing temperature, electrolyte temperature, residence, time and current density show no unusual phenomena.

If the data are analyzed from the standpoint of a combined electrochemical process in which the amount of anodic film formed is proportional to the numbers of Faradays passed and a simultaneous chemical process in which the electrolyte dissolves the anodic film, the process is easily understood.

Acknowledgement

We gratefully acknowledge the help given us by P. Smits of Aluminum Co. of Canada and R. Spooner of Aluminum Laboratories, as well as many colleagues in our own laboratory.

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Tentative Technical Program for February Electrical Insulation Conference

Technical program plans for the Fourth Annual Electrical Conference are nearly complete according to program chairman J. Scott Hurley, Silicone Products Department, General Electric Co., Waterford, N. Y. The conference is being held February 19-22 at the Shoreham Hotel, Washington, D. C. A record turnout of electrical insulation users is expected at the affair—in addition to the technical program there will be commercial exhibits, technical exhibits, tours, a banquet, luncheons, and a marketing session (see another page for details on these other events. The conference is co-sponsored by the American Institute of Electrical Engineers and the National Electrical Manufacturers Association.

A total of 86 papers will be presented in 16 technical sessions. Each paper will be preprinted in the conference publication and will be distributed to registrants. Summaries of the papers will be given orally by the authors with time allowed for audience discussion and questions. It is planned that awards for the best 1962 conference papers will be made at the 1963 conference.

The technical sessions will be held in the morning and afternoon of Tuesday, Feb. 20th, the morning of Wednesday, Feb. 21st, and the morning and afternoon of Thursday, Feb. 22nd. Papers will cover a complete range of insulation materials, electrical and electronic applications, testing, and other topics. The tentative technical program is listed below—the final program along with room locations and other details will be published in the February issue of *Insulation*.

Session Theme: Basic Insulation Behavior

Ionic Conduction in Insulation, A. H. Sharbaugh, General Electric Co.
Polar Polymers, J. D. Hoffman, National Bureau of Standards.
Dielectric Behavior of Glasses and Ceramics, Willis Barney, Corning Glass Works.
Statistical Methods for Predicting Electric Breakdown. W. L. Gore, W. L. Gore Assoc.
Corona Discharges and Their Effects on Insulation, T. W. Dakin, Westinghouse Electric Corp.

Session Theme: Temperature Classification and Thermal Endurance

Fundamental Aspects for Temperature Classification and Thermal Endurance, G. L. Moses, Westinghouse Electric Corp.
Thermal Evaluation Test Procedures for Materials, J. F. Dexter, Dow Corning Corp.
Insulation System Evaluation for Rotating Machines, J. C. Botts, Westinghouse Electric Corp.
Transformer Insulation System Evaluation, F. J. Vogel and W. Farneth, Allis-Chalmers Manufacturing Co.
Users Viewpoint Concerning Thermal Evaluation and Temperature Classification, H. Halperin, Commonwealth Edison Co.

Session Theme: Aging Techniques

End User Comments, Vern Honsinger, Allis-Chalmers Manufacturing Co.
Progressive Temperature Test — A New Approach for Screening Insulation Systems, G. I. Duncan, General Electric Co.
The Significance of Oxygen Permeability of Electrical Insulation Systems in Determining Thermal Endurance, J. T. Wilson and E. Mohaupt. Harnischfeger Corp.
Thermal Aging Studies of Solenoid Coil Insulation Systems, H. P. Walker, Bureau of Ships, Navy Dept., and R. J. Flaherty, U. S. Naval Engineering Experiment Station.
A Method for Heat Aging and Evaluating Thermal Endurance of Coated Sleeving, H. G. Steffens, Natvar Corp.
Discussion of the Statistical Methods Used in the Analysis of Thermal Evaluation Data, T. Orbeck, Westinghouse Electric Corp.

Session Theme: Insulation Resistance Measurements

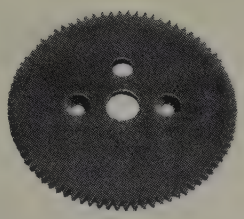
Introductory Remarks, A. H. Scott, National Bureau of Standards.
Instrumentation for Insulation Resistance Measurements, A. Blanck, Picatinny Arsenal.
Electrodes for Insulation Resistance Measurements, A. Blanck, Picatinny Arsenal.
Conditioning for Insulation Resistance Measurements, K. Wechsler, Westinghouse Electric Corp.
Interpretation and Significance of Insulation Resistance Measurements, C. Craig, Sperry Gyroscope Co.
The Field Testing of Electrical Insulation by D-C Methods, E. B. Curdts, James G. Biddle Co.

Session Theme: International Insulation Technology

Keynote, K. N. Mathes, General Electric Co.
The Importance of British Standards in the Application of Electrical Insulation, W. H. Devenish, Electrical Research Association Laboratory.
Mica Paper and Its Application in Europe, Dr. P. Bayard, ACEC.
Development of Electrical Insulation for Large Rotating Machines in Japan, S. Hyakutake, Toshiba.
The Use of Polystyrene Film in Power Capacitors, C. Bozzini and Dr. P. Bayard, ACEC.

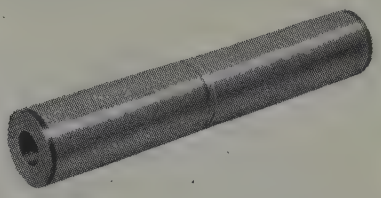
Session Theme: Dry Type Transformers

Keynote, G. A. Monito, Westinghouse Electric Corp.
Survey of Past, Present, and Proposed Materials and Insulation Systems for Dry Type Transformers, J. F. Dexter and L. A. Teichthesen, Dow Corning Corp.
Improved Asbestos-Reinforced Laminates, C. L. Rohn and N. Edgerton, Johns-Manville Co.
Heat and Moisture Resistant Resins for Varnishes and Molding Materials, J. L. Thomas, FMC Corp.
End User Discussion, Frank Hein-



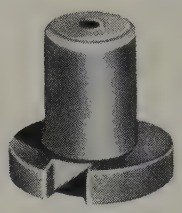
1 Noiseless aircraft gear provides strength, light weight, close tolerances, and eliminates electric shorts or possibility of leaks, reduces costs. Made of INSUROK® T-827.

2 This piece replaces steel adjusting collars, speeds up press time, provides clearer markings, will NOT rust, saves $8.35 per piece. INSUROK T-615 was used.

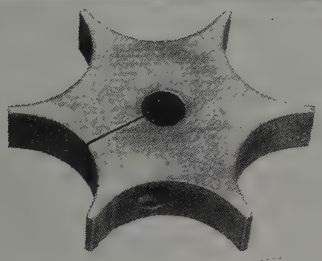


3 Fabricated tube ends duplicating machine problems by resisting developing solutions at less cost than stainless steel or other plastics. INSUROK T-303 and T-643 were used.

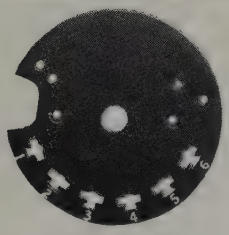
TEN CASE HISTORIES SHOW YOU HOW TO LOWER COSTS, SPEED PRODUCTION, IMPROVE PRODUCTS WITH RICHARDSON FABRICATED PARTS



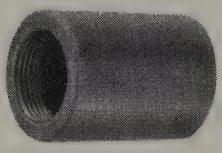
4 Laminated firing pin eliminates cracking during close tolerance machining, cuts production costs $10.00 per thousand, reduces scrap losses. INSUROK T-643 worked perfectly.



5 Substantially lower priced, easier on products, star wheel replaces and outlasts metal or rubber types, acts as safety device. Made from INSUROK T-601.

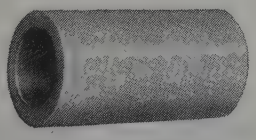


6 Close tolerance fabricated control plate terminal provides clearer markings, is uniform in quality, saves customers $1200 per year. INSUROK T-814 solved the problem.

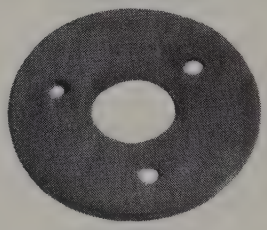


7 Safer laminated tube motor brush holder replaces nylon type because of lower moisture absorption, greater strength and insulation properties. INSUROK TR-303 did the job.

8 This road grader pivot bearing stands up where metals fail, is self-lubricating, provides rugged long life, trouble-free service. Made from graphitized INSUROK T-602.



9 Color-coded sign spacers replace metal, reduce original costs by 10%, eliminate corrosion problems, speed assembly. Solved with INSUROK T-301-TR.



10 Plastic air cylinder cup follower saves 40% in costs, eliminates scratches on cylinder walls, weighs less. INSUROK T-640 replaced metal.

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richs, Pennsylvania Transformer Div., McGraw Edison Co., and W. H. Mutschler, Allis-Chalmers Manufacturing Co.

Session Theme: The Future of Switchgear Insulation

Keynote, W. H. Lane, Allis-Chalmers Manufacturing Co.
The Importance of Low Dissipation Factor Track Resistant Insulation in Switchgear, L. L. Mankoff, General Electric Co.
Dippable Insulation Systems for Switchgear, W. C. Hosford and C. Fazekas, Metal & Thermit Corp.
Insulation for Structural Use in Switchgear, J. L. Cooney, Glastic Corp.

Session Theme: Encapsulated Distribution Transformers

Keynote, W. A. McMorris, General Electric Co.
End User Comments, W. A. Whittlesey, Western Massachusetts Electric Co.
Epoxy Resins for Encapsulated Transformers, F. E. Pschorr and J. R. Weschler, Ciba Products Corp.
HT-1, A New High Temperature Electrical Insulation, W. R. Clay, E. I. du Pont de Nemours & Co.
Some Properties of Two "Epon" Resin Systems for Use as Electrical Encapsulants, R. J. Abelson and J. A. Ditzler, Shell Chemical Co.

Session Theme: Integral HP Motors—High Temperature Performance

Keynote — High Temperature Performance, W. B. Penn, General Electric Co.
An Evaluation of Insulation Systems Based on Polymer "ML", F. E. Schweitzer, J. R. Chalmers, D. M. Glenn, and M. Greif, E. I. du Pont de Nemours & Co.
Insulation Evaluation Techniques for Motors Used on Heavy Duty Portable Tools, D. N. Summerfield and A. F. Gawron, Skil Corp.
High Temperature Magnet Wires and Their Application in Rotating Equipment, W. W. Pendleton and Donald Devries, Anaconda Wire & Cable Co.
Evaluation of Traction Motor Field Coil Insulation Systems, C. W. Paxton and J. F. Dexter, Dow Corning Corp.

Session Theme: Encapsulated Motors

Keynote—Encapsulated Motors, W. G. Stiffler, Reliance Electric and Engineering Co.
End User Comments, W. D. Coxe, Dow Chemical Corp.
Systems Evaluation of Epoxy Molded Coils, J. A. Foerster, Wabash Magnetics Inc.
New Insulation System for D-C Field Coils, W. B. Penn and R. F. Sharrow, General Electric Co.
Performance of Encapsulated Random Wound Motors, C. W. Paxton and L. A. Teichthesen, Dow Corning Corp.
A Study of Dip Encapsulated Motorettes Under Various Environmental Conditions, Leizor Balk and Francis Alessi, Sterling Varnish Co.

Session Theme: Fractional Horsepower Motors

Keynote—Fractional Horsepower Motors, W. T. Gordon, Westinghouse Electric Corp.
Formulating, Testing and Applying Varnish for High Speed Armatures, J. P. Haughney, Sherwin Williams Co.
Synthetic Fiber Insulating Papers for Class B and F. Systems, G. R. Traut, R. C. Berry, N. L. Greenman, Rogers Corp.
Integral Insulation of FHP Motors, Milton V. DeJean, General Electric Co.
Fluidized Bed Application of Epoxy Resin Insulation to Rotating Electrical Machinery, D. L. Slater, Armstrong Resin Inc.

Session Theme: Servicing and Maintenance of Rotating Machinery

Keynote—The Modern Repair Shop, T. C. Keegan, Jr., Federal Insulation Co.
An Approach to the Maintenance of Adequate Resistance Levels on D-C Machinery, C. M. Thorp, Westinghouse Electric Corp.
Insulation Systems in Heavy Duty Electrical Equipment, J. A. Bell and J. Logan, General Motors Corp.
Magnet Wire Windability, E. W. Daszewski, Essex Wire Corp.
Non-Woven Polyester Material, F. Bilanin, Minnesota Mining & Manufacturing Co.

Session Theme: Resins for Electronic Packaging

New Developments and Trends in Resins for Electronic Packaging, M. M. Lee, Leepoxy Plastics.
A Flexible Silicone Resin for Embedding Electronic Circuitry, D. F. Christensen, M. E. Nelson, and R. L. Spraetz, Dow Corning Corp.
Effect of Flame Retardant Modifiers on Low Loss Epoxy Resin System for Use at 160°C, F. T. Parr, Westinghouse Electric Corp.
Improved Thermal Shock Resistance of Electronic Packaging Based on Epoxypolybutadiene Resins, C. W. Johnston, FMC Corp.
Evaluating Flexible Epoxy Systems, C. Cialdella, H. Markowski, and J. Hornburg, Hysol Corp.

Session Theme: Encapsulated Magnetic Components

The State of the Encapsulated Transformer, R. B. Feuchtbaum, Hughes Aircraft Co.
Silicone Electronic Packaging Materials, R. L. Spraetz and D. F. Christensen, Dow Corning Corp.
Resilient Epoxies Applied to Magnetic Components, J. Delmonte, Furane Plastics Inc.
The Dielectric Strength of Epoxy Embedding Compounds, C. C. Scheid, General Electric Co.
The Role of the Resin Formulator in Magnetic Component Manufacture, P. Van Amburgh, EVRA, Inc.
Evaluation of Powder Coatings for Electronic Devices, J. R. Learn, General Electric Co.

Session Theme: Advances in Materials for Electronic Components

New Concepts—Battery Separators, H. P. Gregor, Polytechnic Institute of Brooklyn.
Structure and Properties of Storage Battery Separators, J. A. Orsino, E. J. Dunn, Jr., and W. J. Bundy, National Lead Co.
Cationic Membrane Separators for Fuel Cells, E. A. Oster, R. B. Hodgdon, General Electric Co.
Inorganic Bonded Mica Mat, H. C. Lauroesch, R. J. Ketterrer, and R. W. Staley, General Electric Co.
New Silicone Polymers for Dielectric Cooling Under Extreme Conditions,

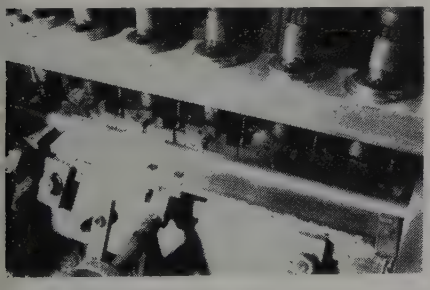
E. D. Brown, General Electric Co.

Session Theme: Thin Film and Electrolytic Capacitors

Recent Developments in Metal Oxides for Capacitor Dielectrics, G. V. Tremblay, Sprague Electric Co.
The Properties of Tantalum Oxide in Electrolytic Capacitors, C. Fincham, National Research Corp.
Characteristics of Magnesium Oxide Dielectric Capacitors, D. Lupher, Gulton Industries.
Silicone Dioxide Capacitors, R. Young, Sprague Electric Co.
Preparation Evaluation of Silicon Monoxide Thin Film Capacitors, I. Pratt, Signal Corps.
Dielectrics on Metals for Evaporated Film Capacitors. F. Maddock, IBM Corp.

Tin Plate Replaces Lead Sheathed Cable

To make a new telephone cable which reportedly costs less than the lead-sheathed cable it replaces, hundreds of paper-covered pairs of fine copper wires are bound together with strong paper tape. A thin sheet of corrugated aluminum laid around the core serves as an electrical shield and lightning protector. An endless ribbon of tin plate (Jones & Laughlin Steel Corp.) is then corrugated and longitudinally wrapped around the cable on high-speed machines. These almost-human machines automatically



solder the tin plate into a solid moisture-proof sheath at a rate of approximately 100 feet per minute. Photo shows bank of induction heaters which melt solder inside seam of tube. After a coating with an asphalt-rubber compound and polyethylene, the completed cable is ready for service.

European Insulation Report

Ed. Note: *The author of this monthly European report is a well-known insulation expert associated with a large European electrical manufacturer. Although it is necessary that his identity not be revealed at this time, correspondence may be exchanged with him by writing* European Editor, Insulation, Box 270, Libertyville, Ill.

Orlitherm, A New High Tension Insulation

By Dr. K. Blinne, O. Mäder, and I. Peter in Bulletin Oerlikon No. 345, June 1961, pp. 37-60. Original title: Orlitherm, eine moderne Hochspannungsisolation. The authors are with Maschinenfabrik Oerlikon, Zurich, Switzerland.

In 1949, Westinghouse introduced their "Thermalastic" insulation for the stator windings of high tension rotating machines and there is no doubt that this was an important technical advance. In Europe at that time, foil insulation wound onto the straight section of the bars contained in the slot using the Haefeli method was the usual practice. Foil insulation has a better mechanical strength at higher temperatures than the continuous mica tape, vacuum impregnated with asphaltic compounds, which is more generally used in the USA. However, in the case of foil insulations, difficulties arose due to the low mechanical strength at service temperatures. The problem was not tape separation but swelling and blocking of the cooling air ducts. For these reasons, the author's firm wished to develop a polymerizable synthetic resin. At first a method was developed with which the installations for the classical Haefeli method of fabrication could be used. In 1953, a new arrangement using an epoxy-mica paper foil was ready for production and this Orlitra system proved to be successful in service. However this system did not satisfy for long the ever-increasing demand for higher quality and it is difficult to wind coils of awkward shapes, e.g. very long bars, with a foil.

Today one expects:

1) High electric strength in order to minimize the thickness of insulation so that the heat transfer coefficient is as small as possible.
2) Low dielectic losses as a function of the applied voltage to show that it is free of voids. This is expected in spite of the very good corona resistivity of today's materials.
3) High mechanical strength against shock so that no rupture occurs under short circuit conditions.
4) High thermo-mechanical strength.

For this purpose the new Orlitherm system was developed. Orlitherm is continuously taped under vacuum. using synthetic-resin impregnated insulation.

One great difficulty concerning the testing of new systems is the evaluation of the life expectancy by carrying out accelerated ageing tests, since only relative results can be obtained. In their ageing tests, the authors compared their results with those obtained from parallel tests on shellac-mica foil, Orlitra, and Orlitherm, since a great deal of operating experience is available for the shellac-mica and also the Orlitra system. As a final complete test under the combination of stresses expected in service, a test was carried out in a stator model with heat cycles and voltage applied. All other tests necessary on materials or combinations of materials in either new or aged condition can only help to make a preliminary choice.

The Orlitra system had an epoxy resin with a solvent, as required for fabrication purposes. For Orlitherm, the company has developed an epoxy resin using titanic acid without any solvents. The authors state clearly that epoxy resins proved much more suitable for vacuum impregnated insulations as used at present than other resins such as polyesters. From the extensive results obtained, the authors concluded that the temperature classification of their epoxy resin is class F. For Orlitherm operating in class F, a glass weave was carefully selected.

As with Orlitra, a mica paper is used. The superiority of mica paper over mica splittings was demonstrated by carrying out bending and shearing tests on different combinations of materials in addition to corona tests on flat plates.

The authors' company has had machines with epoxy and mica paper insulation in successful service for 10 years. The breakdown voltages of such a combination are good (see figure 1).

There is still a diversity of opinion as to whether the quality of an insulation can be judged by the value of tan δ as a function of the measuring voltage. However, the results give a good indication of the quality of the completed insulation. The results can be seen in figure 2.

Printed Circuits

By P. Follini in the Bulletin des Schweizerischen Elektrotechnischen Vereins. Vol. 12, No. 17, August 1961, pp. 645-648. Original title: Gedruckte Verdrahtungen. P. Follini is with Phillips AG, Zurich Switzerland.

The author gives a general view on printed circuits. His opinion is that at present the etching technique is mostly used. A short review of the photographic contact copy and offset print is also given.

Often it is economical to use printed circuits even when only 30 or 50 items are required. Examples of applications and various production problems (soldering, contacts, etc.) are pointed out.

The author expects that in the future printed circuits will become even more important for miniaturization and microengineering techniques, and that this process will be completed by micromodels or solid state circuits.

The Construction of High Frequency Coaxial Cables

By K. H. Hahne in the Bulletin des

Spaulding FIBRE FACTS FOR ENGINEERS NUMBER 5

How to Achieve Permanence at Low Cost

by K. H. Alverson, Product Standards Director

Seldom is a high degree of permanence found associated with the characteristics of dielectric strength, rugged structural strength and arc resistance at such low cost as in Vulcanized Fibre. This permanence and strength allows the engineer to use Vulcanized Fibre to replace more expensive plated or coated parts even where insulating or arc resisting properties are not required.

The reason for Vulcanized Fibre's agelessness lies in the chemical action of its production which arrests the natural tendency of cellulose to deteriorate. This renders Vulcanized Fibre more stable than the hardest wood. (Corrosion, such as attacks metals, is completely precluded since Vulcanized Fibre has a non-mineral base.)

The permanence of Vulcanized Fibre in use is well illustrated by its application as insulation in transformers, switchgear, and circuit breakers. Parts such as corrugated duct spacers, arc chutes and barriers are subjected to terrific arc exposure and must maintain their form, strength and electrical properties for years under continuous operation in hot oil. Lightning arresters and high voltage fuses, made from Fibre tubing for protecting power line transformers, are still in service and operation, in satisfactory condition, after more than twenty years of use.

Industrial fuses with a fibre case and replaceable fuse link are one of the best known uses for Fibre tubing. If the fuse blows, the link is simply replaced and the fuse case used over and over again.

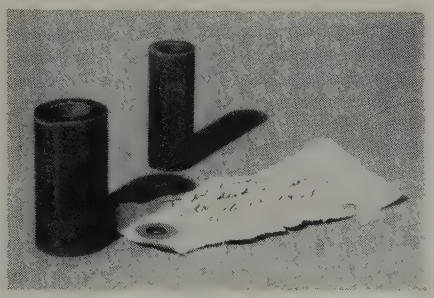
Fibre grommets are used to form a permanent locked-in-place insulator in metal assemblies, such as clocks, motors, etc. They will not deteriorate and fall out as will rubber. Fibre grommets for such applications are approved by the Underwriters' Laboratories.

Fibre is non-corroding, unaffected by oils, greases, solvents, etc. It withstands the pounding of heavy trains when used as track insulation under outdoor exposure. Easily formed into complex shapes for use in athletic equipment, welding helmets, etc., all of which must withstand harsh usage without failure.

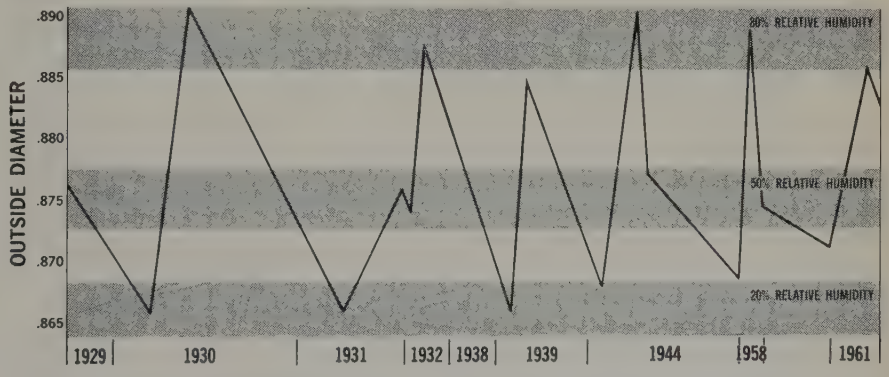
Trunk coverings, sample cases, factory trucks and waste baskets have been made for years of Vulcanized Fibre to take advantage of the light weight, abrasion resistance and permanence of the material.

Because of its many unique characteristics, Vulcanized Fibre offers a virtually endless variety of applications.

Spaulding Engineers who have been trained in Value Analysis can help you take advantage of the wide range of possibilities in designing to reduce costs through the use of Vulcanized Fibre parts. They also make available to you Spaulding's extensive fabricating facilities and experience in working with this extraordinary material.



While many materials deteriorate over the years, Vulcanized Fibre maintains its essential properties for decades. Note how the linen tag attached to Fibre tube samples in 1929 shows age, but Fibre tubes look and act as they did 32 years ago.



Long term test of fibre, which has been going on since 1929, shows that fibre still responds to wide humidity changes in the same way it did when test began. Predictable changes in dimension occur when fibre tubing is subjected to extremes of humidity. Tests such as these prove that there is no change in Vulcanized Fibre characteristics over long periods of time.

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New Value Analysis Brochure a detailed review of the Spaulding Value Analysis technique together with case histories of design improvement and cost reductions that have been accomplished through Spaulding's Value Analysis of customer products. 12 pages.

Vulcanized Fibre Engineering Data — a design reference book which comprehensively covers all the application specs of Vulcanized Fibre. 10 pages.

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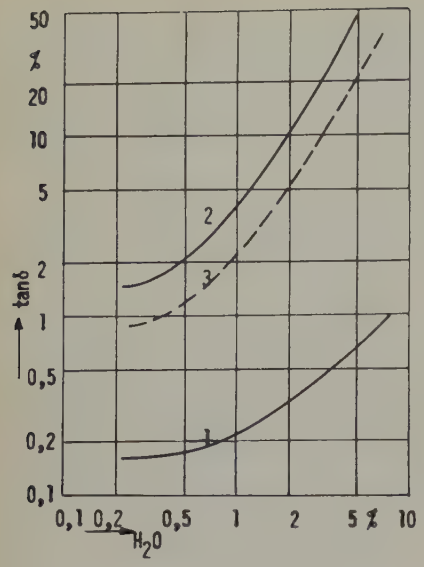

Figure 1, tan δ value of paper insulation at 50 c/s as a function of the water content (% H_2O) which is given as a percentage of the dry weight. Curve 1 is measured at 20°C, curve 2 is measured at 110°C, and curve 3 is measured at 90°C.

Schweizerischen Elektrotechnischen Vereins. Vol. 52, No. 18, September 1961, pp. 725-728. Original title: Die Fabrikation von Hochfrequenz-Koaxialkabeln. Dr. Hahne is with Felten and Quilleaume, Carlswerk AG, Köln-Mühlheim, West Germany.

In order to transmit frequencies in the range of 50 kc/s to 10^9 c/s, coaxial cables are normally employed.

The inside conductor is usually a copper tube or wire. Several separately insulated transposed conductors are used only when flexible cables are necessary, since this construction is expensive due to the need for a large, specially built machine.

The simplest dielectric is an extruded thermoplastic material. However, with lower voltages it is preferable to have a quantity of dry air as a dielectric. For this reason a foaming agent is added before extrusion to increase the proportion of air. To retain the mechanical strength, a helical spacer is wound between the inner and outer conductors. Sometimes, extruded distance discs are also used.

For the dielectric, low dielectric losses which are independent of the frequency are necessary. Polyvinylbenzol, polystyrol, polyethylene, or even fluoroethylene and ceramics are used depending on the temperature stress. For high service voltages, the breakdown strength of air would not be enough so polyethylene is usually used for the full insulation. For flexible cables polyisolbutylene is usually used.

Some methods used for the manufacture of the outer conductor are also given, such as a copper weave or a tube which is sometimes seam-welded onto the cable.

In this publication, various applications of different cables are given, and two typical manufacturing techniques are fully described.

First 400 KV Oil-filled Cable in Great Britain

In the G.E.C. Journal (The General Electric Company Ltd., England) Vol. 28, No. 2, 1961, pp. 62-65.

In Great Britain cables are required for the transmission of power at 400 kv. For this reason, Pirelli-General Ltd. has developed and submitted for type approval a complete cable system for this voltage. The cable is of the low-pressure, oil-filled, single conductor, hollow core type. The accessories are an outdoor sealing end, an oil-immersed seal, and a straight-through joint and a stop joint so that the cable can be terminated in the entry box of a transformer.

Data and dimensions of the cable are:

Overall cable diameter	4.10 inch
Conductor cross-section	0.9 in^2
Maximum stress at working voltage (nominal)	160 kv/cm
Insulation thickness (minimum)	0.90 inch
Impulse voltage withstand level	1400 kv
	Diameter (mm)
Oil duct	8
Steel spiral	9.02
Conductor	32.9
Conductor screen c.b. paper	33.8
Insulation w.p. paper	81.2
Insulation screen c.b. paper interlocked with perforated metallized paper	81.75
Lead alloy sheath	88.36
Impregnated cloth tape	
Six plain copper wires longitudinally applied.	
Impregnated cloth tape	
Two h.d. tin-bronze tapes 0.75 inch x 0.006 inch in parallel	89.89
Serving overall	104.27

The type tests are carried out as follows:

1) Power factor/voltage test at ambient temperature with twice the working voltage applied.
2) Bending test followed by a voltage test of 425 kv applied for 15 minutes.
3) Measurement of thermal resistivity.
4) Mechanical test on sheath reinforcement, 7 days at a pressure of 150 lb/in^2.
5) Thermal cycle test, 20 daily cycles up to 90-100°C conductor temperature, with 308 kv applied continuously.
6) Thermal stability test, 6 hours at 95°C and 308 kv.
7) Impulse withstand test.

In the second part of the article, the testing facilities in the company's new high tension laboratory are described.

In May 1961, the Swiss Electrical Engineers Association held a conference in Zurich on the theme, "The Application of Vacuum in the Manufacture of High Tension Material." The various speeches and discussions are now published in the latest Bulletin des Schweizerischen Elektrotechnischen Vereins, Vol. 12, No. 19, September 1961. Summaries of these interesting speeches follow (some will also appear in the December issue of *Insulation*).

The Drying and Vacuum Impregnation of High Tension Transformers

By A. Goldstein in Bulletin des Schweizerischen Elektrotechnischen Vereins, Vol. 12, No. 19, September 1961, pp. 757-764. Original title: Trocknung und Vakuumimprägnierung von Hochspannungstransformatoren. Dr. Goldstein is with Brown Boveri Ltd., Baden, Switzerland.

It is well known that the quality of the oil-paper insulation in a transformer is dependent on the moisture content in the insulation. The higher the moisture content, the higher are the values of tan δ (see figure 1). This means that the danger of thermal breakdown becomes greater. The breakdown strength of the oil is also a function of the moisture dispersed in the oil. The 50 c/s breakdown voltage of oils containing 60 gm H_2O

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†ASTM D-149.

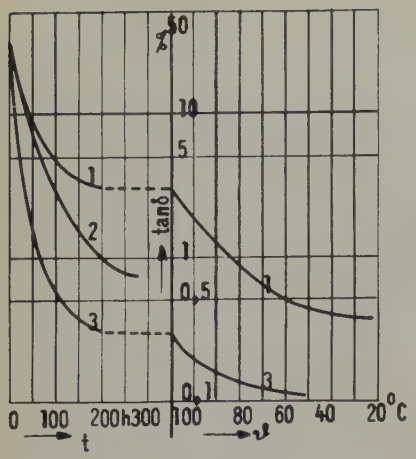


Figure 2, tan δ value of paper insulation by different dryings. Left: as a function of the drying time at 110°C. Right: as a function of the temperature τ during the cooling process. Curve 1 represents heated air drying under normal air pressure; curve 2, vacuum drying at 8 Torr; and curve 3, high vacuum drying at 0.2 Torr.

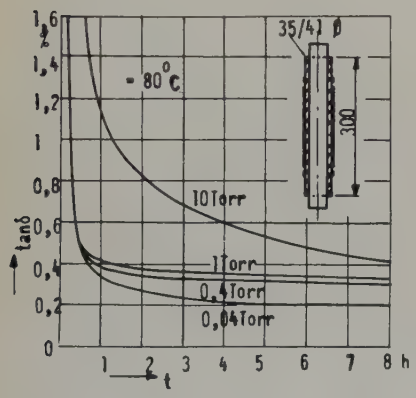


Figure 3, vacuum drying of a model winding at different pressures. For the model tested see the right corner: h = hours.

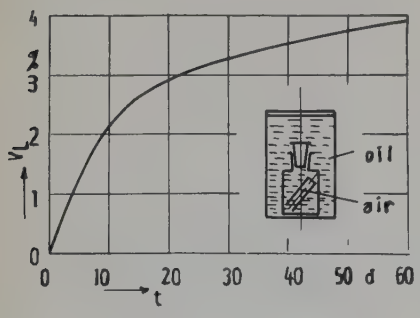


Figure 4, absorption of air into a degassed oil at room temperature. Oil volume = 380 cm³; free oil surface = 6.1 cm². V_L is the air absorbed at the oil surface as a % of the volume: d = days.

per ton is 40 kv/cm. For oil with 10-40 gm per ton it is 180-220 kv/cm, and with 1 gm per ton it is 330 kv/cm.

The water content of paper insulation is increased with increasing partial pressure and decreasing temperature. The author stipulates that on the basis of known physical facts it is essential to dry transformer insulation by applying heat and vacuum before impregnation with oil.

The temperature should not be below 60°C because it is known that at lower temperatures under high vacuum the water on the inside of a relatively thick insulation will freeze on account of the latent heat of vaporization and the poor heat conductivity of the insulation.

In figure 2, a comparison between different dryings is given showing that the tan δ result is a good indication of the efficiency of the drying process. An expensive vacuum drying installation capable of handling the largest transformers is a very good investment. From figure 3 it can be seen that it is not efficient to use very high vacuum.

A good oil impregnation of the dried paper insulation is very important, since all air pockets in the electrical field must be eliminated in order to avoid partial breakdowns, destruction of the insulation, and X-wax formation. The oil must be dried out and degassed and the construction of the transformer must permit air bubbles to escape during the high vacuum impregnation. The problem of the solubility of air in oil is not yet absolutely clear and it is evidently dependent on different factors. In figure 4, the author gives the results of an interesting test.

The ageing of oil and of paper insulation have different consequences. Oxygen and humidity cause a depolymerization of the cellulose molecules, causing the paper to lose its mechanical but not its electrical strength.

As oil ages, its tan δ increases so that the risk of thermal breakdown becomes real. It is possible to avoid this risk by replacing the oil, which also causes a decrease in the tan δ value of the paper insulation.

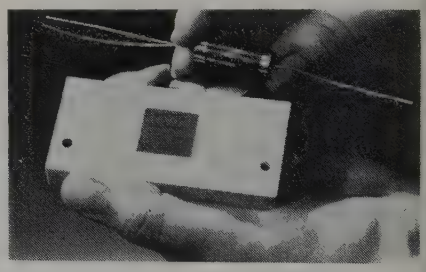
To avoid thermal breakdown, adequate oil ducts should be provided in the main paper insulation. Experience has shown that a tan δ value of 200 percent gives no difficulty. Such values are, of course, not acceptable in a transformer because of the bushing.

The best method to avoid ageing is to totally enclose the transformer. The author recommends only systems where the sealing is done in the oil expansion tank. For this sealing, rubber membranes or nitrogen are proposed.

Miniaturized Delay Line

In a delay line (Spira-Coil, produced by Com-Tronics Co., Los Angeles) which has a temperature coefficient of 50 ppm degree C or better regardless of the impedance, a nonporous "Fiberfilm" (made from glass microfibers and polytetrafluoroethylene), one mil thick, is used as a capacitor to provide miniaturization and high band pass under a rigorous thermal environment and yet provides thermal stability.

The inductors of the Spira-Coil are placed in close proximity in order to achieve miniaturization of the delay



line. The film insulation (made by American Machine & Foundry Co.) compensates for the high mutuals which develop. The low insertion loss of the package results from lumped constant design and high "Q" capacitors. The dielectric constant of the film (1,000 volts) and dissipation factor are said to help produce a high band pass—a good feature in a delay line. The working voltage of 1,000 volts is well above the usual 600-volt working range. The result is a miniaturized delay line which is stable in operating temperatures from minus 55°C to 125°C.

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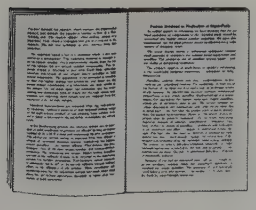

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New Publications

DC "Hypot" Testing of Cables, Transformers and Rotating Machinery, by Harold N. Miller. Covers tests, test techniques, operating procedures, etc., and contains a high potential d-c testing bibliography. 30 pages, $2. Associated Research Inc., 3758 W. Belmont Ave., Chicago 18, Ill.

IPCEA-NEMA Standards Publication for Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy. 84 pages, $3.50. Order from either Insulated Power Cable Engineers Association, 283 Valley Road, Montclair, N. J., or the National Electrical Manufacturers Association, 155 E. 44th St., New York 17.

Value Engineering, Volume 2, edited by Richard S. Mandelkorn, Rear Admiral, USN (Ret.). Explains how the principles of modern value engineering are used to reduce the cost of manufactured products while maintaining, and even improving, the quality. Based on Second Electronic Industries Association Conference on Value Engineering. Hard cover, 167 pages, illustrated, $7.50. Engineering Publishers, P. O. Box 2, Elizabeth, N. J.

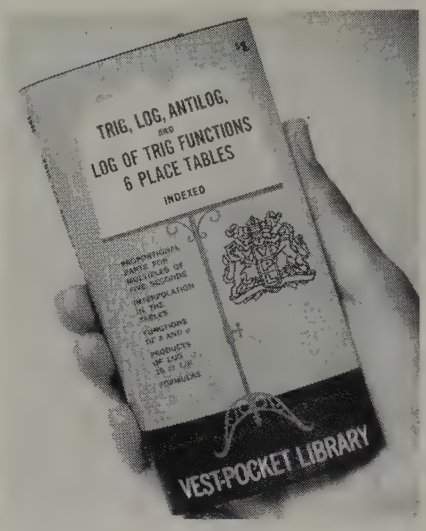
Handbook of Miniature Parts for Electronic Equipment. 150 pages, 75 cents. Order Catalog No. D 211.6/2: E12/3 from Supt. of Documents, Govt. Printing Office, Washington 25, D. C.

Handbook of Chemistry and Physics, by Hodgman, Weast, and Selby. New 43rd edition of this excellent standard reference work contains nearly 80 pages of new material, plus revised and expanded data. 3467 pages, $12. The Chemical Rubber Co., 2310 Superior Ave., Cleveland 14, Ohio.

Engineering Index. Bound volume contains all information issued during 1960 by weekly index of technical publications. Engineering Index Inc., 29 W. 39th St., New York 18. 1759 pages, over 34,000 annotations, $75.

Periodical Monitor. A new magazine, it is said to provide engineers with immediate reference to hundreds of articles on electronics and instrumentation each month. Abstracts are cross-referenced. There is no advertising. The Perodical Monitor and Abstract Service, 15 N. Euclid Ave., Pasadena, Calif.

Trig, Log, Antilog, Log of Trig Functions 6 Place Tables. Besides the tables listed in the title, there are eight pages of formulas, eight pages of interpolation, and other valuable in-



formation in this handy Vest-Pocket Library book. 2⅝" x 5⅝", 192 pages, $1. Ottenheimer Publishers Inc., 4805 Nelson Ave., Baltimore 15, Md.

Proposed Amendments to the 1959 National Electrical Code (NFPA No. 70 PR-1961). 390 pages, $2.50. National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

American Standards

The following new or revised standards publications may be obtained from the American Standards Association, 10 E. 40th St., New York 16.

C7.22-1960, *AS Specifications for Concentric-Lay-Stranded Aluminum Conductors, Steel-Reinforced (ACSR)*, (ASTM B232-60T), 30 cents.

C7.28-1960, *AS Specifications for Standard Weight Zinc-Coated (Galvanized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)*, (ASTM B245-60). 30 cents.

C7.34-1960, *AS Specifications for Zinc-Coated (Galvanized) Steel Core Wire (With Coatings Heavier than Standard Weight) for Aluminum Conductors, Steel Reinforced (ACSR)*, (ASTM B261-60). 30 cents.

C7.39-1960, *AS Specifications for Copper Conductors for Use in Hookup Wire for Electronic Equipment* (ASTM B286-60T).

C7.41-1960, *AS Method of Test for Stiffness of Bare Soft Square and Rectangular Copper Wire for Magnet Wire Fabrication* (ASTM B279-60). 30 cents.

C7.42-1960, *AS Specification for Half-Hard Aluminum Wire for Electrical Purposes* (ASTM B323-60). 30 cents.

C7.38-1960, *AS Specifications for Silver-Coated Soft or Annealed Copper Wire* (ASTM B298-60). 30 cents.

C7.40-1960, *AS Specifications for Aluminum Wire for Communications Cable* (ASTM B314-60). 30 cents.

C7.20-1960, *AS Specifications for Hard-Drawn Aluminum Wire for Electrical Purposes* (ASTM B230-60). 30 cents.

C7.21-1960, *AS Specifications for Concentric-Lay-Stranded Aluminum Conductors, Hard, Three-Quarter Hard, and Half-Hard* (ASTM B231-60). 30 cents.

C7.23-1960, *AS Specifications for Rolled Aluminum Rods (EC Grade) for Electrical Purposes* (ASTM B233-60). 30 cents.

C7.24-1960, *AS Method of Test for Resistivity of Electrical Conductor Materials* (ASTM B193-60). 30 cents.

C7.43-1960, *AS Specifications for Rectangular and Square Bare Aluminum Wire for Electrical Conductors* (ASTM B234-60). 30 cents.

C7.8-1960, *AS Specifications for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft* (ASTM B8-60). 30 cents.

C59.21-1961, *AS Method for Sampling Electrical Insulating Oils* (ASTM D923-59). 30 cents.

C33.10-1961, *American Standards for Fuseholders*. 75 cents.

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- Maximum abrasion resistance
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After braiding onto wire or cable, the covering is sintered by the manufacturer at about 650 F., causing a slight flow of the Teflon—just enough to bond it with adjacent strands for an unbroken Teflon coating.

J-M Fiber Glass Yarn is coated with 12% or 15% Teflon, or to meet your specifications. It is available in these sizes: 450-1/2 . . . 225-1/2 . . . 150-1/2 . . . 150-1/3 . . . and 150-2/2. The yarn is supplied in plied constructions on multiple-end wound braider and serving packages for use with standard braiding equipment.

For more details, call your Johns-Manville Representative. Or write J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N.Y. In Canada: Port Credit, Ont.

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Industry News

Astrex Inc., New York City, has acquired *U-Test-M Manufacturing Corp.* and *Midland Distributing Corp.*, both of Milwaukee, Wis., and their affiliates. They make radio and television self-service tube testing equipment, and distribute radio and television tubes sold through self-service testers, respectively.

Pyramid Instrument Corp., Lynbrook, L.I., N.Y., producer of portable electrical test equipment, has changed its name to *Amprobe Instrument Corp.*

The Silicone Products Dept., *General Electric Co.*, has opened a new sales office in Dayton, Ohio, and named *Smith of Philadelphia Inc.* to distribute its electrical insulation products in parts of Pennsylvania. New Jersey, and Delaware.

Northwest Plastics Inc., St. Paul, has purchased *Hermitage Plastics*, Nashville, Tenn., manufacturer of miniature electrolytic condenser enclosures, for more than $100,000. Hermitage, which also manufactures seamless tubing and formulates epoxy compounds, will continue as a wholly owned subsidiary.

Tempo Instrument Inc. has moved to a new plant at the Technical In-

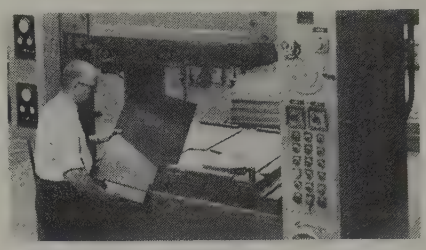
dustrial Park in Plainview, L.I., N.Y.

The *Solvents and Chemicals Companies* have been named to distribute synthetic resins made by the Pine and Paper Chemicals Dept., *Hercules Powder Co.*, Wilmington, Del., in Cincinnati, Louisville, Indianapolis, Detroit, Dallas, and Houston. *Moreland Chemical Co.* will distribute the same products in Spartanburg, S.C.

Taylor Fibre Co. has expanded both its main plant at Betzwood, near Norristown, Pa., and its West Coast plant at LaVerne, Calif.

The *Huse-Liberty Mica Co.*, Peabody, Mass., now represents the *Rostone Corp.*, Lafayette, Ind., in New England.

The Glastic Corp., Cleveland, has installed a new 320-ton molding press



to make fiber glass mat reinforced polyester parts.

Insulation Manufacturers Corp. has been appointed to distribute "Teflon" insulating products made by *Raybestos-Manhattan Inc.*, Manheim, Pa.

The Carborundum Co. plans a $1½ million modernization and expansion of production capacity for its *Globar Electronics Plant* in Niagara Falls, N.Y.

Geoscience Instruments Corp. has moved to larger facilities in New York City.

Multi-Amp Electronic Corp. has moved to a new 15,400 sq ft plant in Cranford, N.J.

Comco Plastics Inc., Richmond Hill, N.Y., has added a "Teflon" extrusion operation to its fabricating and molding facilities.

Norton Co., Worcester, Mass., is studying ways and means of creating a public market for its stock. A new employee stock purchase plan is also under active consideration.

Consolidated Ceramics and Metalizing Corp. was recently formed in Flemington, N.J. to produce ceramic and metalized ceramic parts. Officers are Jay E. Comeforo, president; Kenneth P. Doerselm, vice president; and F. Richard Cass, treasurer.

Crocker, Burbank & Co., Fitchburg, Mass., has been awarded a contract by the US Army Signal Corps to develop quality control measures for the manufacture of capacitor tissue.

Multi-Amp Electronic Corp. has moved to a new 15,400 sq ft building on a two-acre tract in Cranford, N.J.

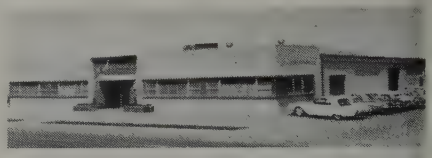
A new standards laboratory for the measurement and calibration of d-c voltage and current, as well as resistance, has been established in Glen Cove, L.I., N.Y., by *North Hills Electronics Inc.*

The Zippertubing Co., Los Angeles, has appointed *Radio Supply Co. Inc.* to distribute its cable jacketing and shielding in Virginia.

Cabot Corp., Boston, Mass., has agreed to purchase from *Acheson Industries Inc.*, Port Huron, Mich., the *Acheson Dispersed Pigments Co.*, Philadelphia, and its subsidiaries and affiliates in Orange, Texas; Xenia, Ohio; and Dukinfield, Chesire, England.

Wabash Magnetics Inc., Wabash and Huntington, Ind., plans to establish an Advanced Engineering Development Laboratory in the new Purdue Industrial Research Park, Lafayette, Ind.

Data Sensors Inc., Gardena, Calif., has been formed to manufacture elec-



trical, electronic, and electro-mechanical instruments.

Miniature Instruments Inc., Minneapolis, has acquired *Peptone Electronics Inc.*, manufacturer of universal car radios.

Erinac Equipment Corp., New York City, has been appointed exclusive US and Canadian importer and distributor for the insulating, lacing, and winding machines made by Firma Hanns Fickert, Frankfurt, Germany.

Fluorocarbon manufacturing facilities have been more than doubled by *W. L. Gore & Associates Inc.*, Newark, Del.

National Beryllia Corp., Haskell, N.J., has installed equipment for supplying beryllia and alumina shapes metallized and plated on one or more surfaces, printed circuits on beryllia or alumina, and brazed ceramic-to-metal assemblies.

The A.P.M. Corp. has moved to a new plant in Englewood, N.J.

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People in the News

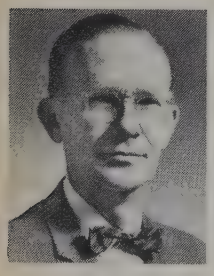
James E. Eastlake, consultant with The Macallen Co. Inc., Newmarket, N.H., passed away in his office, August 29, 1961.

At Union Carbide Corp.: *Richard S. Abrams,* general manager, Silicones Div., to manager of development, UC Olefins Co.; *James C. Malone,* assistant general manager to general manager, Silicones Div.; *Robert A. Charpie,* assistant director of Oak Ridge National Laboratory to manager of advanced developments, UCC. At UC Plastics Co.: *William C. Nissen,* technical sales representative to project manager of polypropylene; *Frank G. Bertics,* sales representative to assistant midwestern sales manager; *James N. Barton,* new western sales representative.

Allied Chemical Corp.: *Robert A. Miller,* NYC sales manager to sales manager for specialty plastic films; *Don A. Proudfoot,* Simpson Timber Co., to general marketing manager, Barrett Div.; *Charles B. Miller,* director of laboratory research to assistant technical director; *Curtis B. Hayworth,* director of development research to assistant technical director.

R. Miller

D. Proudfoot



C. Miller

C. Hayworth

Joseph A. Conlon, marketing manager, Rubber Products Div., Dayco Corp., Melrose Park, Ill., to sales vice president.

Edward Bachorik, sales vice president to executive vice president, Allied Control Co. Inc., New York City.

Albert L. Soule III, Chicago distributor sales manager to Chicago district manager, Phelps Dodge Copper Products Corp.

New titles at Shawinigan Resins Corp., Springfield, Mass.: *James A. Snelgrove,* research section leader, surface coatings; *Peter M. Draghetti,* group leader, adhesives; *Donald M. Gardner,* group leader, physical chemistry and polymerization methods; *Joseph G. Martins,* group leader, polyvinyl butyral and polyvinyl formal; *David S. Cox,* assistant manager, product development department; *Stedman C. Herman,* technical service manager, adhesives; *Robert W. Ross,* technical service manager, electrical insulation; *Herbert Terry,* technical service manager, surface coatings; *Irving Ash,* district sales manager, New Jersey; *Bruce E. Porter,* district sales manager, Cleveland, Ohio.

A. J. Benkoczy to director of engineering, United States Fiberglass Co., Miami, Fla.

John E. Faloon to West Coast sales manager, Haveg Industries Inc., Taunton, Mass.

William R. Browne to fiber glass products sales, Johns-Manville Sales Corp., New York City.

Brand-Rex Div., American Enka Corp., Concord, Mass.: *R. J. Rodday,* director of manufacturing to director of marketing; *T. M. Hinds,* special assistant to general manager to director of manufacturing; *Frank G. Stefkovich,* western sales manager to assistant plant manager (Gardena, Calif.); *R. C. Babbit* to quality control manager, Gardena plant.

Edwin W. Wilbert has been named general manager of Miniature Products Div., Wabash Magnetics Inc., Wabash, Ind.

John J. Mancino has been appointed vice president and general manager of American Super-Temperature Wires Inc., Winooski, Vt., division of Haveg Industries Inc.

New technical services manager of Redel Inc., Anaheim, Calif., is *Robert C. Wayne.*

At the Military Electronics Div., Daystrom Inc., Archbald, Pa., *Bert Fleming* has been appointed senior manufacturing engineer, electro-mechanical devices, and *Donald S. Taylor* has joined the division as a development engineer.

B. Fleming

D. Taylor

The Silicone Products Dept., General Electric Co., has promoted *W. L. Batty, Jr.* to manager of its western district. His office is in Downey, Calif. Also, *James H. Morrison* has been named a sales representative there. At G-E's Insulating Materials Dept. in Schenectady, N.Y., *Richard S. Armstrong* has been promoted from technical service engineer to the sales unit, and *Edward M. Donegan* has been appointed manager of materials,

J. Morrison

J. Castles

W. Batty

W. Harney

manufacturing. At Pittsfield, Mass., *John T. Castles* has been appointed general manager of the Chemical Materials Dept.

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FILM COATED

magnet wire

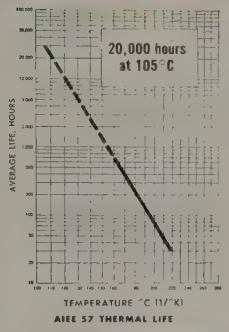
There's a "right-wire" for you in this full Essex line. Each one has job engineered differences specifically developed for your applications. Selecting the proper Essex magnet wire will assure you of greater efficiency . . . with minimum trouble and down time. Some of the differences and applications are typified in the examples given below.

Enamel Class 105C	Formvar Class 105C	Acrylic Class 105C	Modified Formvar Class 105C	Self-Bonding Formvar Class 105C	Nylon Class 105C	Formvar-Nylon Comb. Class 105C	Urethane Class 105C	Non Slipping Urethane Class 105C	Urethane-Nylon Comb. Class 130C	Self-Bonding Urethane Class 105C	Epoxy Class 130C	Mod. Polyester Class 155C	Silicone Class 180C	M.L.* Class 220C
Plain or Black Enamel	Formvar	Acrylex	Formetex	Bondex	Nylon	Nyform	Soderex	Gripex	Soderon	Soderbond Soderbond N	Epoxy	Poly-Thermalex Nytherm Thermalex F	Silicone	Allex

FORMVAR

Service record unequaled in wire industry assures years of trouble free service. Size range—round wire 4 through 52 single, heavy, triple, quadruple. Squares and rectangles up to 100,000 square mils.

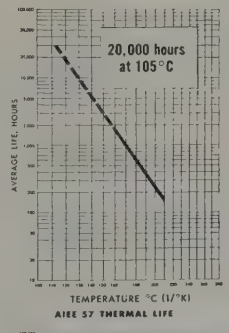
Applications: Class A motor windings, round wire coils of all types, hermetic applications when hermetic grade specified, shaped wire coils, oil filled transformers.



NYFORM

The complete dependability of Formvar with a plus factor in windability. Size range—round 4 through 44 single, heavy, triple, quadruple.

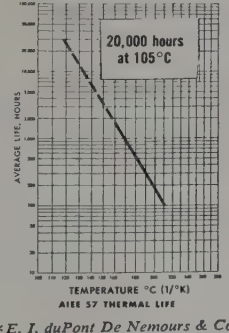
Applications: High speed motor windings, hand tool motor armatures, Class A coils and transformers of all types. Particular adaptability where overload resistance is required.



SODEREX®

Solderable without film removal. Size range—10 through 52 single, heavy, triple, quadruple.

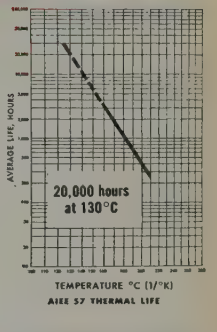
Applications: Electronic coils, light duty motor and armature windings, transformer coils, relays. The correct choice for a product requiring solderability without stripping in the finer wire sizes. Particularly recommended for solderable insulation on sizes 28 and finer.



SODERON®

Combines the features of Soderex with exceptional windability. Size range—4 through 44 single, heavy, triple, quadruple.

Applications: Light duty stator and armature windings, transformers, relays, coils. Particularly recommended for 27 and heavier wire where solderability is a requirement.

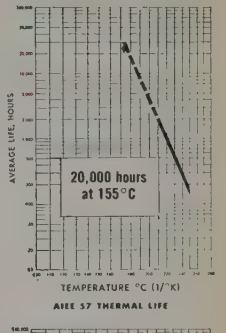


POLY-THERMALEX/PTX

A Class F magnet wire at Class A prices offering machine windability. Size range—4 through 40 single, heavy, triple, quadruple. Squares and rectangles up to 100,000 square mils.

Applications: General purposes—motors Class A through F, dry type transformers, relay coils. An excellent replacement for glass fabric wire.

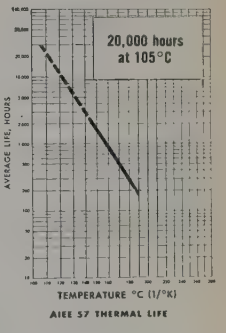
Licensed Under Patents Pending



PLAIN ENAMEL

Premium wire at a reduced cost for coil work. Size range—10 through 52 single and heavy.

Applications: Relays, paper section coils, power transformers, low voltage automotive coils. Will not exhibit resistance to physical abuse associated with synthetic films.



*E. I. duPont De Nemours & Co. — Type ML Resin.

For your magnet wire planning contact Essex for instant assistance

MAGNET WIRE DIVISION

ESSEX WIRE CORPORATION
Fort Wayne, Indiana
National Network of Warehouses and Sales Offices

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Association News

Chambers Elected President of Illuminating Engineering Society

James R. Chambers, Appleton Electric Co., has been elected 1961-62 president of the 10,000-member Illuminating Engineering Society. Other new officers elected are J. Dixon Mitchell, Westinghouse Electric Corp., vice-president; Charles L. Amick, Day-Brite Lighting Inc., general secretary; and Arthur C. Barr, General Electric Co., treasurer.

SPE Technical Conference in Pittsburgh, Jan. 30-Feb. 2

"Plastics Revolutionize Design" is the theme for the 18th Annual Technical Conference of the Society of Plastics Engineers, to be held at the Penn-Sheraton Hotel in Pittsburgh, January 30 through February 2, 1962.

Highpoint of the conference will be a technical paper to be presented by Professor Guilio Natta of Montecatini in Milan, Italy. His subject will be "Progress in Stereo-Regulated Polymers." Approximately 100 additional papers will be read.

Technical areas to be covered in the more than 26 sessions include new plastics formulations such as polyolefins, urethanes, and polystyrenes (processing, properties, and applications); reinforced plastics (uses and new developments in testing); and plastics-metals combinations. Other topics for discussion under plastics process technology are injection molding and extrusion, fast-moving blow molding and thermo-forming, and auxiliary plastics processing equipment. In addition, special sessions are scheduled for applications of plastics in building and in space vehicles and missiles.

The annual business meeting of the society will take place at a luncheon on January 31, and an education luncheon scheduled for January 30 will feature a prominent engineering educator as guest speaker. On February 1, the customary "speechless" banquet will be held, with a special ladies' program arranged for wives of conference registrants.

General chairman of the conference is John E. Parks, Hydraulic Press Manufacturing Co. Other officials are Chester F. Stuver, Automotive Equipment Co., vice chairman, arrangements; Charles A. Infante, Dow Chemical Co., vice chairman, program; Robert R. Hornickel, Mine Safety Appliance Co., secretary; R. Bruce Johnson, Jr., Dow Chemical Co., treasurer; and Paul E. Cornyn, Koppers Co. Inc., publicity chairman.

Reliability and Quality Control Meeting in Washington, Jan. 9-11

The annual National Symposium on Reliability and Quality Control will be held Jan. 9-11 in the Statler Hilton Hotel, Washington, D. C.

The symposium is backed by the Institute of Radio Engineers' Professional Group on Reliability and Quality Control, the Electronics Industries Association, American Institute of Electrical Engineers, and the American Society for Quality Control.

M. P. Smith has been selected as chairman for the symposium. He is manager of reliability at the Aeronautical Div., Military Products Group, Minneapolis-Honeywell Regulator Co.

Form North Piedmont Sub-Section of AIEE

A North Piedmont sub-section of the American Institute of Electrical Engineers has been formed. Part of the North Carolina Section, it includes the counties of Alamance, Guilford, Randolph, and Rockingham. Sub-section officers are R. O. St. Clair, chairman, and T. B. Sanders, secretary-treasurer.

National Electrical Week Scheduled for Feb. 11-17

"Electricity Powers Progress" will be the theme of the 1962 National Electrical Week, February 11-17.

Harold A. Webster, president of the National Electrical Contractors Association, is chairman of the National Electrical Week Committee.

Webster and the three officers who served on the 1961 NEW Committee

Dolph's® makes it easy to select the right class F varnish from industry's most complete line

Now, Dolph makes it easy to select the Class F HI-THERM® insulating varnish that's formulated right and priced right for all of your insulating requirements. No need to pay a premium price for performance you don't need on one job . . . or settle for below-spec performance on another. Use this guide to select the right varnish at the right price from Dolph's complete, job-proven, Class F line. For complete data on Class F varnishes, write for folder IN-1.

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were all re-elected for 1962. They are: T. O. McQuiston, Metropolitan Edison Co., vice chairman; A. W. Hooper, National Association of Electrical Distributors, secretary; and L. W. O'Brien, General Electric Co., treasurer.

The committee will again distribute planning guides and materials for nation-wide and local observances of NEW. Last February, NEW activities were carried on in more than 300 communities in this country and in Canada.

Insulation Symposium Papers Requested For Spring Electrochemical Meeting

The Electric Insulation Division of the Electrochemical Society plans to hold symposia at the 121st meeting of the society at the Statler-Hilton Hotel in Los Angeles, May 6–10, 1962. Plans are being made for sessions to be held on the following subjects: 1) Ceramics and Integrated Circuits, session chairman—B. R. Eichbaum, Aeronutronics, Newport Beach, Calif.; 2) Thin Film Dielectrics and Electrolytic Capacitors, C. C. Houtz, Bell Telephone Laboratories, and R. A. Ruscetta, General Electric Co., Irmo, S.C.; 3) Reliability, Hans M. Wagner, Lockheed Aircraft Corp., 3251 Hanover St., Palo Alto, Calif.; and 4) Paper, E. D. Eich, Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y.

As in the past, all that is required for presentation at an Electric Insulation session is that a 75-word abstract be in the hands of the session chairman by December 15, 1961.

ASTM Invites Papers for 1962 Symposium on Cleaning and Materials Processing for Electronics and Space Apparatus

A symposium on cleaning and materials processing for electronics and space apparatus will be held during the Fourth Pacific Area National Meeting of the American Society for Testing Materials at the Statler-Hilton Hotel, Los Angeles, Sept. 30 to Oct. 5, 1962. The society invites all individuals interested in presenting a paper to submit the title and a 200-word abstract to Dr. D. E. Koontz, Bell Telephone Laboratories Inc., Murray Hill, N. J., no later than January 1, 1962.

Ceramic Materials Symposium

A symposium on "Ceramics and Cermets, Bodies and Coatings" will be included in the fall meeting of the Society of Aerospace Materials and Process Engineers at the Biltmore Hotel, Dayton, Ohio, on Nov. 14-15. Symposium chairman is G. A. Clark, North American Aviation, Columbus, Ohio.

ASTM Changes Name

The name of the American Society for Testing Materials has been changed to the American Society for Testing and Materials.

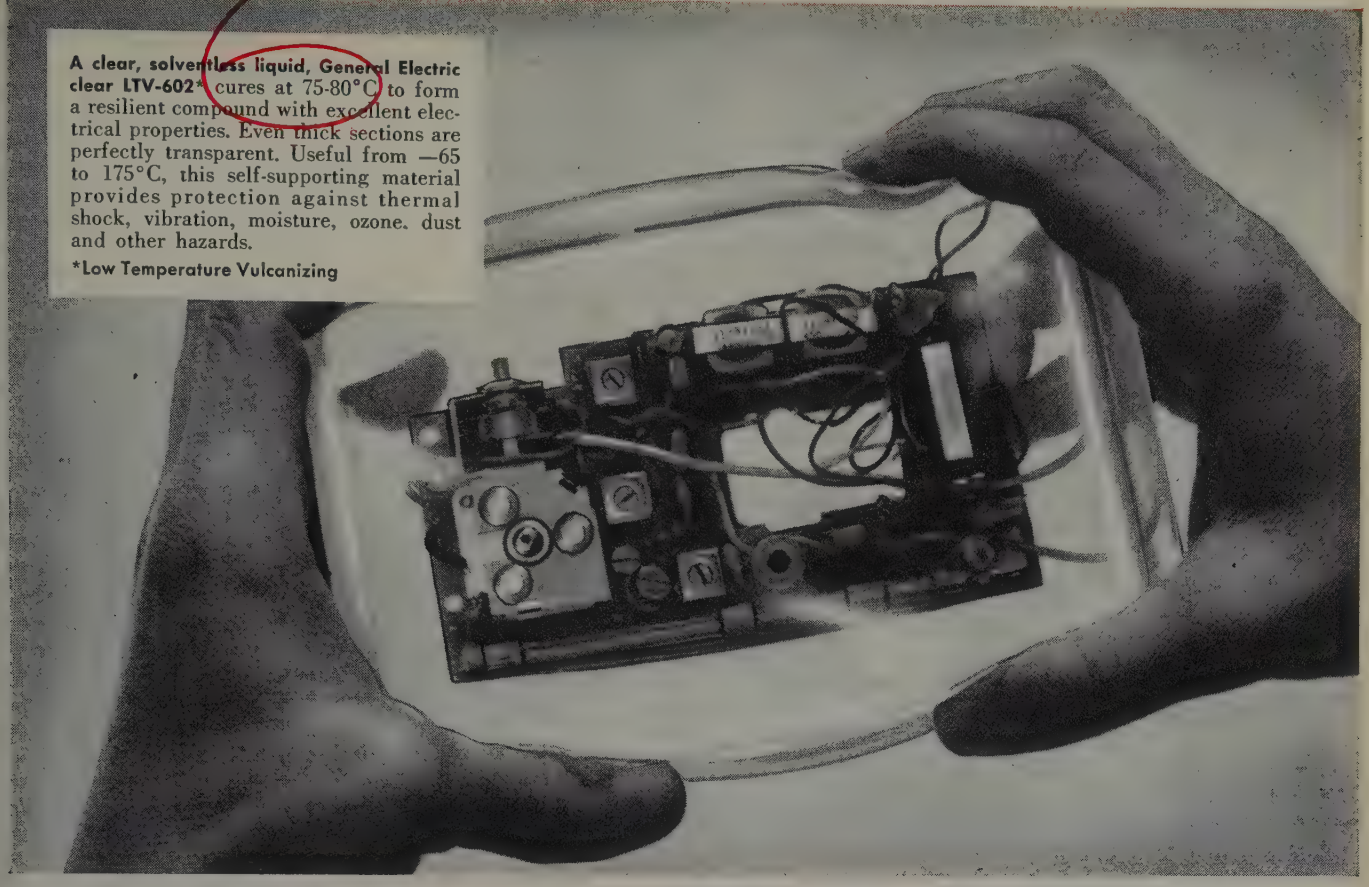
EIA Elects Two Directors

Two new directors elected by the Electronic Industries Association are: Wilfred L. Larson, Switchcraft Inc., for the Parts Division, and Neil K. Dietrich, Hazeltine Corp., for the Military Products Division.

NOW CURES FAST AT ROOM TEMPERATURE TOO!
(OR 2 HOURS WITH HEAT)

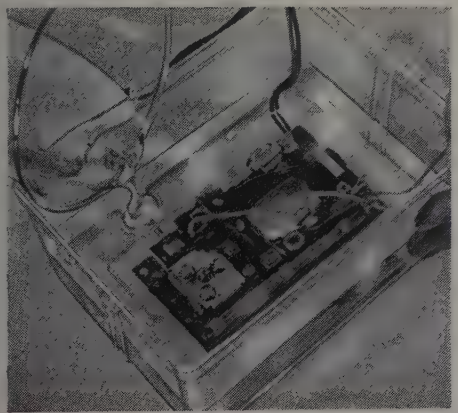
A clear, solventless liquid, General Electric clear LTV-602* cures at 75-80°C to form a resilient compound with excellent electrical properties. Even thick sections are perfectly transparent. Useful from —65 to 175°C, this self-supporting material provides protection against thermal shock, vibration, moisture, ozone, dust and other hazards.

*Low Temperature Vulcanizing

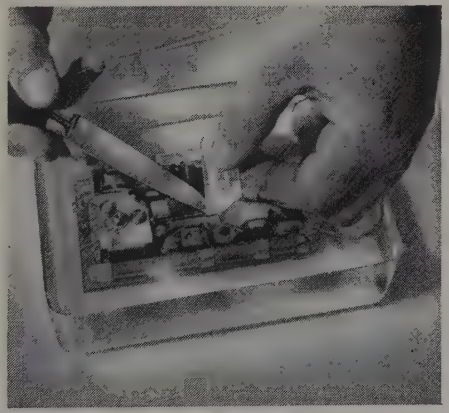


General Electric clear LTV silicone compound for potting and embedding

Transparent, resilient, self-supporting and easy to repair



LTV-602 is easily applied, flows freely in-and-around complicated parts. Having a low viscosity in the uncured state, 800-1500 centipoise, LTV is ideal for potting and embedding of electronic assemblies. Unlike "gel-like" potting materials, LTV-602 cures to a flexible solid. Oven cure is overnight, or from 6 to 8 hours at 75 to 80°C.



LTV-602 is easy to work with and easy to repair. To repair parts embedded in LTV, merely cut out and remove section of material, repair or replace defective part, pour fresh LTV into opening and cure. Pot life, with catalyst added, is approximately 8 hours and may be extended with refrigeration. When desirable, LTV may also be cured at room temperature.

Resiliency offers excellent shock resistance. LTV-602 easily meets thermal shock tests described in MIL-STD-202A test condition B which specifies five temperature cycles from —65 to 125°C. Tests indicate that LTV retains protective properties even after 1800 hours aging at 175°C. Other tests confirm LTV's resistance to moisture and water immersion.

LTV-602 is the newest addition to the broad line of G-E silicone potting and encapsulating materials which also include the RTV silicone rubbers. For more information, write to General Electric Company, Silicone Products Department, Section M1163, Waterford, New York.

3 TIMES FASTER THAN BEFORE

V CURES IN OURS – CAN EN USE HEAT LAMP!

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GENERAL ELECTRIC

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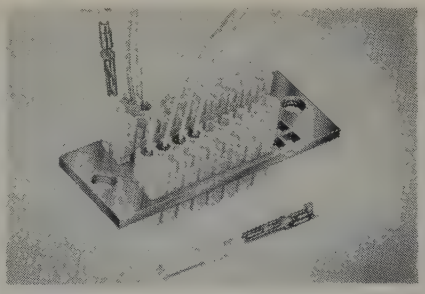
New Materials and Components

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card —no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Snap-In, Nylon-Insulated Terminal

Bifurcated contacts, lances for "snap-in" insertion into a nylon insulator, double rolled crimp portion, strain relief, and an inspection port are featured in new "Shur-Lok" connectors designed for high reliability in electronic gear (such as computers and data processing systems) when subjected to severe vibration and stress. This new connector is said to be extremely flexible in application (a design engineer can design as



many contacts into as many configurations as his project may require). The entire unit is encased in a nylon insulator. Circuitry changes can be made by removing the female pin with a withdrawal tool, which depresses the lances so the contact can be pulled out at the back of the insulator. The nylon insulator also provides for self-alignment and "float" when a mating male blade is engaged. National Connector Corp., Science Industry Center, Minneapolis 27, Minn.

Print No. Ins. 101 on Reader Service Card

Irradiated Insulation for Coaxial Cable

A new series of cellular, irradiated polyolefin insulating materials, designated "Electrocel," have been designed to impart to coaxial cable a combination of superior heat resistance and toughness with low capacitance and reduced attenuation. They are said to be especially suited to applications where space and weight savings—without loss of dielectric efficiency—are of major importance. The materials are available as insulation in coaxial cable with either "Electroset" S/E (irradiated polyolefin jacketing) or standard PVC jacketing. Radiation Materials Inc., 36-32 37th St., Long Island City 1, N. Y.

Print No. Ins. 102 on Reader Service Card

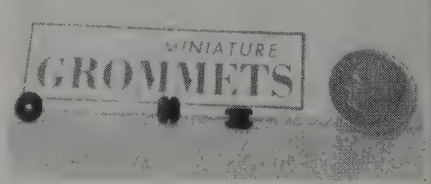
Epoxy/Glass Laminates for Use Under High Temperature, Vibration

New grades EG 824 and EG 824-T unclad and copper-clad flame retardant high temperature laminates are said to comply with the requirements of Mil-P-18177B (Type GEB) and Mil-P-13949B (GB), a NEMA grade G-11 material. These flame retardant laminates reportedly retain at least 50% of their flexural strength after exposure to 300°F (149°C) for one hour when tested at 300°F. Average minimum bond strengths of approximately 12 lbs/in for 2 oz copper cladding and 10 lbs/in for 1 oz copper cladding are reported. These laminates were designed primarily for printed circuit applications where ambient temperatures and vibration requirements exceed those of the regular G-10 laminates. Literature available. The Mica Corp., 4031 Elenda St., Culver City, Calif.

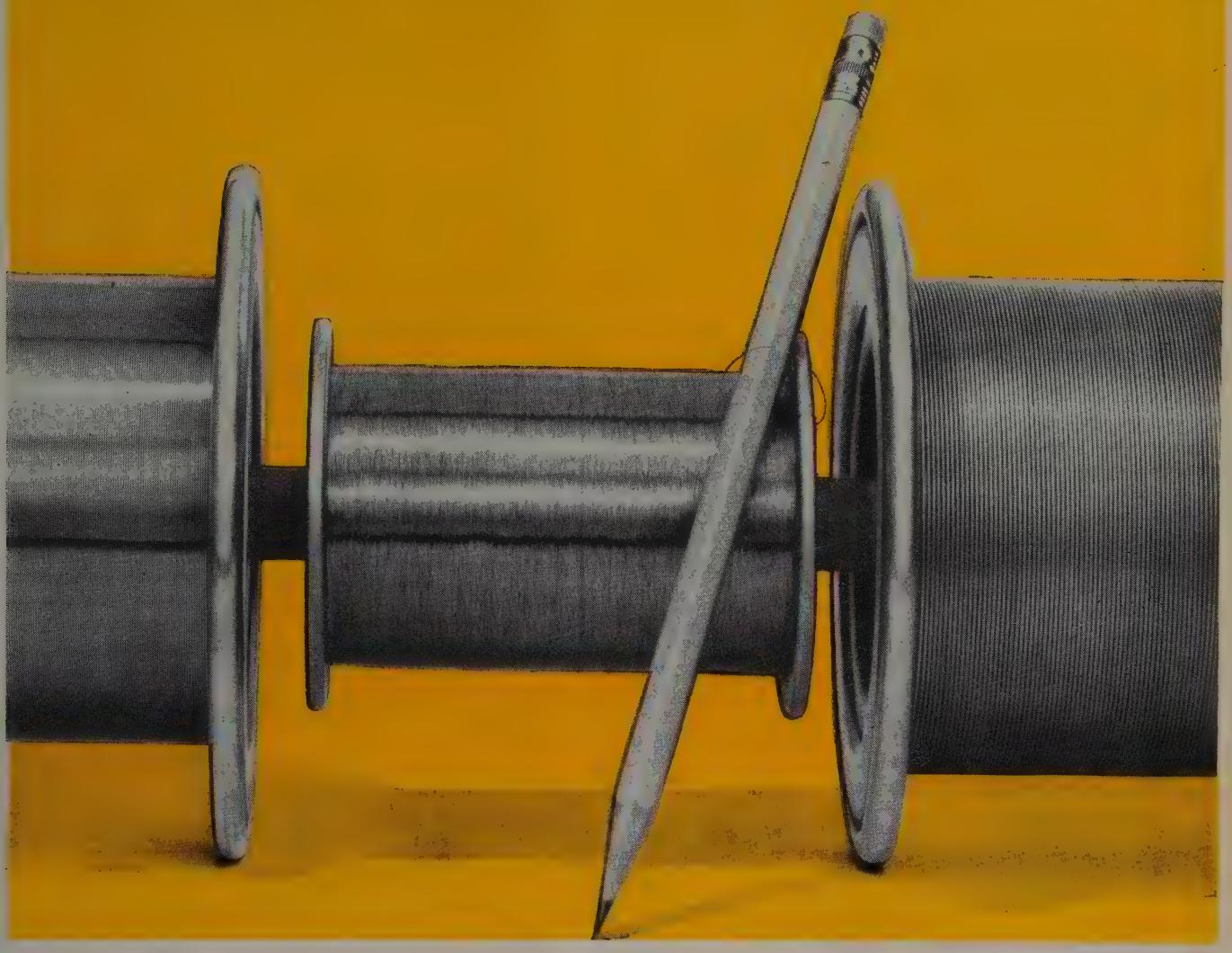
Print No. Ins. 103 on Reader Service Card

Miniature Grommets for Electronics and Missiles

New series of miniaturized grommets for use in the electronic and missile fields are available in sizes as small as .059″ ID and .072″ thick. These grommets are available in reg-



SYLVANIA MAKES ALL THREE—ALLOY, CLAD AND PLATED WIRE



Where to start when you're writing specs

—Let Sylvania give you an unbiased recommendation on wire

When you're designing and specifying materials for special purpose applications, selection of the proper wire can be all-important. Clearly, there are wide variations in corrosion resistance, oxidation resistance, strength and conductivity.

That's why more and more engineers *start* with Sylvania when they specify wire. Of all major manufacturers, only Sylvania makes all three types of bare wire – alloy, clad and plated. Sylvania makes them in a full range of sizes, too–.002″ to .250″. Each and every one retains optimum characteristics up to recommended operating temperatures.

With such a complete line, you can be sure that a Sylvania recommendation is unbiased. It's based on *your* needs—*not* restricted by a limited line. Full details—for future use or help on a present project—are yours at Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania. Call or write.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

GENERAL SYSTEM

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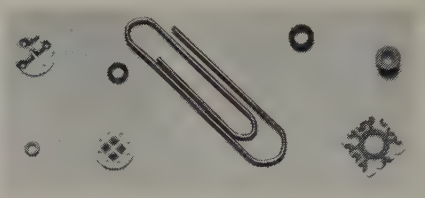
ular rubber or synthetic compounds, or in high and low temperature silicones or other special elastomers. Minor Rubber Co. Inc., Ackerman St., Bloomfield, N. J.

Print No. Ins. 104 on Reader Service Card

Subminiature Metallized Ceramic Bases for Mounting Transistors

Subminiature metallized ceramic bases for mounting transistors consist of a high alumina ceramic wafer or washer in the order of .010" thick which has been metallized using the moly-manganese process. The conductive patterns are then nickel or gold plated to allow lead attachment as



well as direct mounting of the silicon to the ceramic. Advantages claimed for the alumina ceramic base include: 1) excellent vibration resistance and mechanical strength; 2) high temperature properties (as high as 1700°F); 3) sub-miniaturization with no sacrifice of leakage path; 4) impervious to corrosive acids used in device processing and zero porosity; 5) close matching of the thermal expansion rate of silicon semiconductor crystal and direct mounting. Advanced Vacuum Products Inc., 430 Fairfield Ave., Stamford, Conn.

Print No. Ins. 105 on Reader Service Card

Zip-On PVC Covers Protect Cable Splices

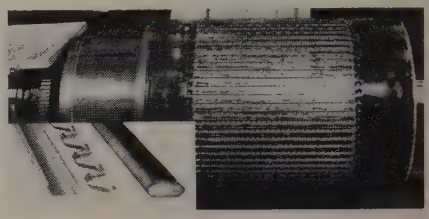
Protective splice covers of polyvinyl chloride can be wrapped around spliced areas of cables and locked on

by a plastic zipper closure. When the ends of the Zippertubing splice covers are clamped or taped to the cable, an effective moisture barrier is said to be created. Tracks of the zipper closure may be permanently fused together with a sealer to provide a permanent water-tight protection for the spliced area. The Zippertubing Co., 13000 S. Broadway, Los Angeles 61, Calif.

Print No. Ins. 106 on Reader Service Card

Slot Liner Design Increases Heat Dissipation 20°C

A new, snap-in slot liner using "Mylar"-faced epoxy glass laminate and a length of square, stainless steel wire is stated to have produced a 20°C increase in heat dissipation and a saving in excess of five cents per slot in railroad traction motors. The class F laminate is said to be formed to extremely tight radii without cracking or crazing and to have sufficient spring-back after forming to be self-retaining. The square wire is laid



into the slot and crimped in place. It greatly increases air turbulence across the motor. In 1,000-hr high potential tests at more than 200°C and in 60 cycle vibration tests at very high amplitudes, the laminate reportedly maintained the required integrity without ruptures. The development may also permit further increases in power for traction motors. Swedlow Inc., 394 N. Meridian Road, Youngstown 9, Ohio.

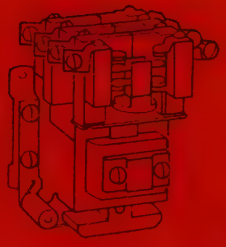
Print No. Ins. 107 on Reader Service Card

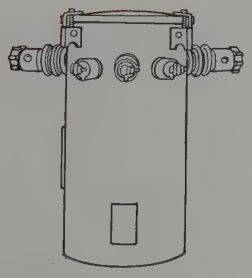
Low Viscosity Epoxy Resins For Filament Winding

Two new epoxy resins are now available for filament winding systems requiring high tensile elongation and good handling characteristics. Designated "Bakelite" ERL-2256 and ERL-2258, both are stated to have excellent physical properties and handling characteristics that make them ideal not only for filament winding but also for laminating applications. ERL-2256 is especially recommended for both wet lay-up and bag molding. The new resins cure well with anhydrides and aromatic amines at room temperature but are not recommended for use with methyl nadic

Important news from Belden..

High Heat ML Magnet Wire for continuous operating temperatures to 250C





HELPS ENGINEERS DESIGN SMALLER AND LIGHTER PRODUCTS!

Here's the ideal magnet wire for motors, hermetically sealed relays, dry-type transformers, generators, encapsulated windings, and similar products that must operate continuously at temperatures up to 250C. Belden ML Magnet Wire is coated with ML Polymer, a DuPont product.

- ML is highly resistant to abrasion . . and it winds easily.
- ML will take substantial overloads . . it has high heat-shock resistance to 425C.
- ML can be combined with glass-wrap insulation to obtain additional insulation characteristics.
- ML magnet wire minimizes "gassing" which often causes contact contamination in sealed relays when conventional magnet wire is used.
- ML can replace any film coated magnet wire . . except where solderability is required.
- ML is available from stock. For additional information contact Belden Manufacturing Company, P.O. Box 5070-A, Chicago 80, Illinois.

Other Belden Magnet Wire: Beldenamel*, oleoresinous • Beldsol*, polyurethane-nylon • Beldbond*, polyurethane-bonding agent • Beldure*, polyurethane • Beldtherm*, polyester • Celenamel*, cellulose acetate • Formvar, vinyl acetal • Nylclad*, vinyl acetal-nylon • Epoxy

One Wire Source for Everything Electrical and Electronic

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lead wire • power supply cords • cord sets • portable cordage • electronic wire • control cables • automotive replacement wire and cable

*Belden T. M. Reg. U. S. Pat Off.

1-2-1

anhydride. ERL-2256 has a viscosity range of 500-900 cps at room temperature, and ERL-2258 has a range of 100-500 cps at 25°C. Both are difunctional and reportedly have a long pot life and, properly cured, exhibit excellent mechanical properties. Glass reinforced structures prepared from ERL-2256 are said to have flexural. tensile, and edgewise compressive strengths well in excess of those required by Mil-R-9300A, Type I. ERL-2258 hardened with a modified eutectic blend of aromatic amines (ZZL-0820) also is said to have good mechanical properties, e.g., a very high tensile elongation of 7%, and a heat distortion point of 160°C. Union Carbide Plastics Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17.

Print No. Ins. 108 on Reader Service Card

Improved Nylon-Insulated Rivets

Standard "Insulet" rivets now have oval heads with larger diameters than the old style flat heads, thereby giving greater head bearing area and lower design profile. Bearing area under the head has been increased by 50% in the smaller sizes and up to 100% in the larger sizes. Advantages claimed include: 1) Reduced cold-flow of the nylon at elevated temperatures, thereby minimizing fastener loosening. 2) Less nylon squeeze-out under the head during rivet setting operation. Hence, dielectric strength

is not reduced. 3) Tighter clamping of insulated stacks. 4) Elimination of need for thick bearing plates over thin contact blades. 5) Neater design appearance. 6) Easier automatic feeding. Fasteners consist of semi-tubular metal rivets whose shank and under-the-head surfaces are uniformly covered with nylon insulation giving 5000 volts protection. These fasteners are used in electrical and electronic applications where it is necessary to fasten two or more metal parts together and yet not have the parts connected electrically. Literature, prices, and samples available. Pylon Co. Inc., Attleboro, Mass.

Print No. Ins. 109 on Reader Service Card

Hot Pressed Silicon Carbide Alumina Ceramic

A patent (No. 3,979,414) has recently been granted covering the formulation of silicon carbide with high alumina materials to produce a ceramic material of high strength and hardness. The processed material, as described in the patent claims, would have increased hardness, strength, and resistance to corrosion at elevated temperatures as compared to commercial alumina presently available. Higher density resulting from the lower void area would result in greater wear resistance. Added advantages would be a better thermal conductivity and a finer RMS finish and variations of electrical characteristics for usage in semi-conductor and substrate applications. The material could thus be used either as an insulator or as a conductor by varying the silicon carbide percentage in the formulation. Diamonite Products Mfg. Co., subsidiary of The United States Ceramic Tile Co., Shreve, Ohio.

Print No. Ins. 110 on Reader Service Card

Electrical Components Protected By High Temperature Adhesive

A new high temperature adhesive for protecting electrical components reportedly can sustain temperatures up to 1000°F (538°C). Other applications of "Raiseal" 350 in use and under consideration include bonding copper to glass fiber/epoxy laminates, and other laminating processes where high temperature and high electrical resistance are primary requisites. Raiseal-bonded laminates are claimed to have shown no subsequent delamination after being dipped into hot solder. Raiseal pretreated asbestos forms are finding industrial use in the encapsulation of potted electrical components. The forms insulate the potted component both thermally and electrically. Dip impregnation of the asbestos forms into thinned 350 is said to increase their electrical resistance and improve their bondability

to metal surfaces. The asbestos pores are then made impervious by joining the two surfaces with uncut 350, which acts both as a bonding agent and as a sealant. As a structural adhesive, 350 is stated to be very effective where high temperature resistance, superior electrical properties, and/or rigidity are required. Developmental kits and data sheets available. Radiation Applications Inc., 36-40 37th St., Long Island City 1, N. Y.

Print No. Ins. 111 on Reader Service Card

Rigid PVC Electrical Conduit

A new line of plastic electrical conduit, developed for use underground or encased in cement, consists of rigid polyvinyl chloride pipe, elbows, couplings, and adapters ranging in size from ½″ to 6″ in diameter. It has UL approval for underground applications. The pipe is extruded in 10-ft lengths with one end coupled, and is expected to find wide application in electrical installations in concrete slab floors, in harbor areas where underground conduit is subject to salt water erosion, along freeways, and in residential developments. The plastic electrical conduit is said to be free from corrosion, rust, or the effects of electrolysis, to be nonconducting and non-magnetic, and to show no reaction to bare ground wires even in moist soils. It is reported to weigh one-sixth as much as steel, one-half as much as aluminum, and to be installed in one-third the time required for metal conduit. Lasco Industries, Montebello, Calif.

Print No. Ins. 112 on Reader Service Card

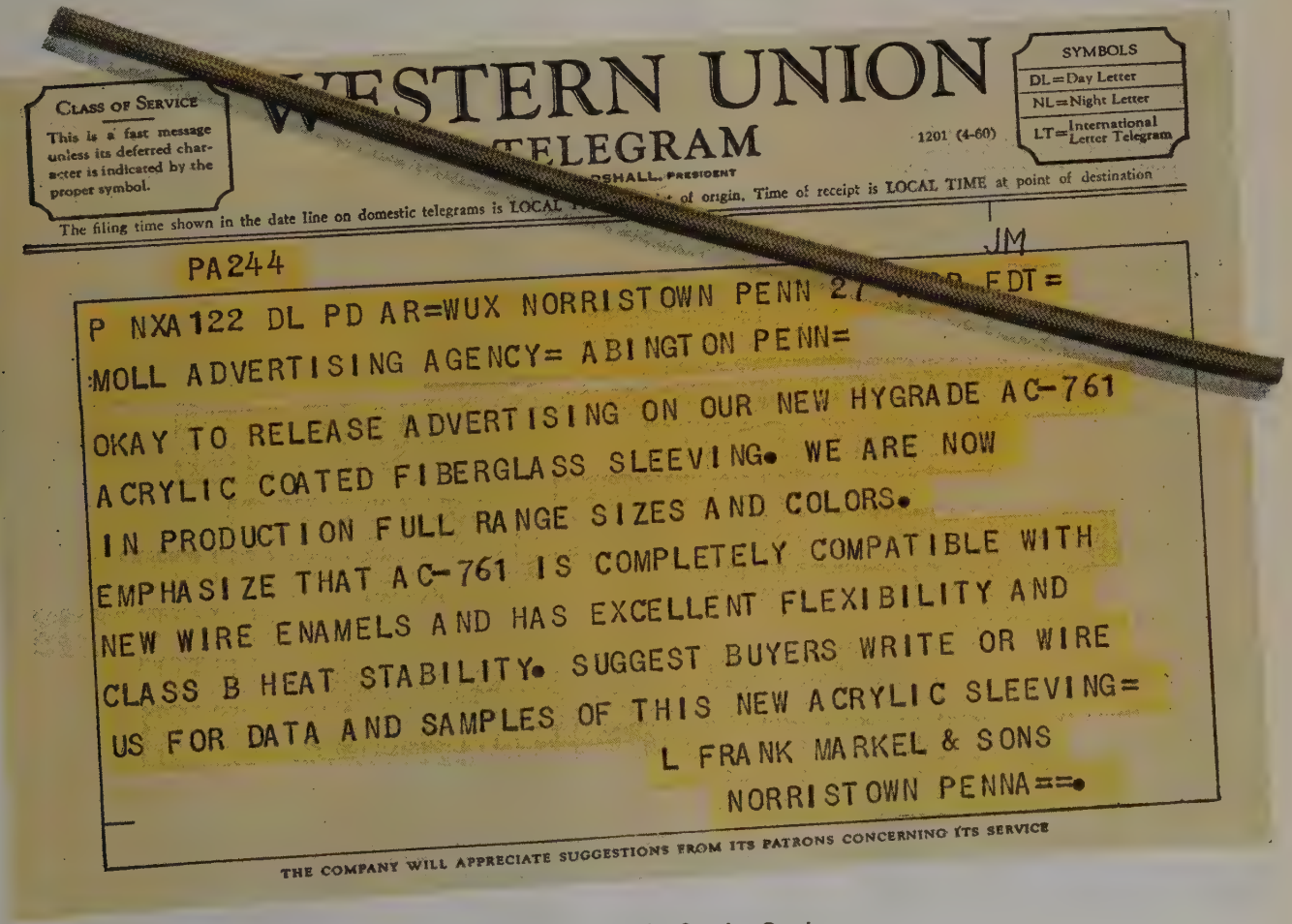
First Modified Polypropylene For Insulating, Other Uses

Said to be the first modified polypropylene to join the family of engineering thermoplastics, "Oleform" is expected to find a substantial market in applications requiring toughness, rigidity, and electrical insulating properties over a wide temperature range. The new material is a blue-gray molding resin. Properties reported include high rigidity and heat distortion values, excellent dimensional stability and creep resistance as compared with other thermoplastics, chemical resistance and low moisture absorption superior to competitive materials, an extremely low loss factor, outstanding electrical insulator attributes, and easy processing (substantially the same as unmodified polypropylene). Promising markets are seen in parts for electrical and electronic components, appliances, wiring devices, and other applications where high temperature, dimensional stability, and superior electrical properties are required. Technical data sheets available. AviSun Corp., 1345 Chestnut St., Philadelphia 7, Pa.

Print No. Ins. 113 on Reader Service Card

Plasticizer for Vinyl High Temperature Wire Insulation

A new primary plasticizer said to have outstanding permanence has been designed to meet the service requirements of high temperature wire insulation. "Truflex" 300 is stated to offer several features to the vinyl compounder among which are particularly low volatility for a primary, excellent retention of physicals after prolonged heat aging, an inherent resistance to moisture, and outstand-



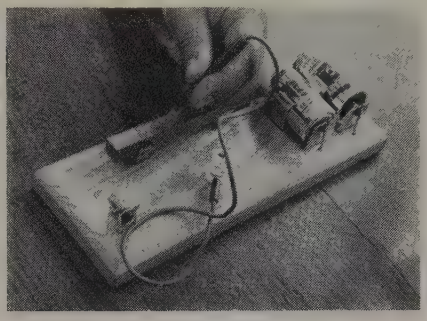
Print Ins. 25 on Reader Service Card

ing electrical properties. It is also claimed to blend readily with polyvinyl chloride resins and to be compatible with practically all other plasticizer types. Thompson Chemical Co., 90 Mendon Ave., Pawtucket, R. I.

Print No. Ins. 114 on Reader Service Card

Conductive Plastic for RF, Waveguide, Flush Printed Circuits, Other Electronic Applications

A new plastic material is reported to have very nearly ideal conductive properties. Illustration shows a 3-volt bulb being lighted by two 1½ volt batteries wired in series with a probe and a bar of the new plastic material. A brilliant light is obtained no matter

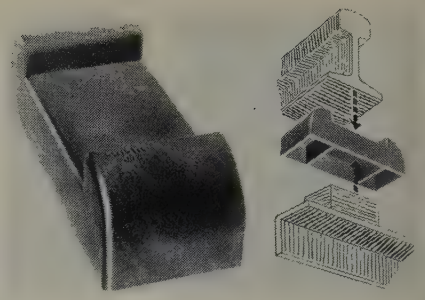


where probe is applied to the bar. Applications include waveguide, RF connectors, and electronic components. Pilot uses of the material have found it particularly well adapted to the production of printed circuits where a flush surface is desired. Mesa Plastics Co., 12270 Nebraska Ave., Los Angeles 25, Calif.

Print No. Ins. 115 on Reader Service Card

Fiber Glass Reinforced Plastic Insulating Supports for Third Rails

New insulating supports for exposed third rails of overhead cranes and other heavy duty, conductor rail handling equipment reportedly combine high impact strength, long lasting insulating properties, and ease of installation. The crane rail insulators are molded of fiber glass reinforced polyester. Ability to withstand the severe, continuous shock loads inherent in crane operation, to resist carbon tracking that is caused by arcing from the third rail, and to bear up under strain caused by thermal expansion and contraction of long continuous rail installations are featured. Cored construction of the insulators is said to save material, reduce weight, and make them easier to in-



stall than bolt-on type insulating supports (see illustration). The insulators are also stated to have 6 to 8 times greater impact strength than porcelain insulators. Complete data, including dimensions and prices, are available. The Glastic Corp., 4321 Glenridge Road, Cleveland 21, Ohio.

Print No. Ins. 116 on Reader Service Card

Carbon Material for Thermal And Electrical Insulation

A new carbon material, "Hitco-C", which was developed to solve severe high temperature insulation problems in the aircraft and missile fields, is also expected to have many electrical insulation and other industrial applications. The material, virtually pure carbon, has both thermal-insulation and erosion-barrier applications. Principal properties reported are lower thermal conductivity and a low ablation rate when combined with phenolic resin. Others include compatibility with most resin systems and with all reinforced-plastic fabrication techniques. Hitco-C is made in both fiber form and in fabric rolls. Warp breaking strength is reported to be 25 lb/in or greater. Molded and laminated parts fabricated with Hitco-C

also are said to demonstrate excellent physical properties. Technical bulletin 1-3B available. H. I. Thompson Fiber Glass Co., 1773 Cordova St., Los Angeles 7, Calif.

Print No. Ins. 117 on Reader Service Card

Improved Aluminum Coil Strip Conductor

Aluminum coil strip conductor now is available in .016" to .051" thick-

nesses with edges mechanically conditioned to have smoothly rounded corners. The manufacturing process is said to eliminate burrs and other irregularities that may exist on the edges of ordinary slit strip and which may interfere with compact winding of electromagnetic coils and damage insulating media. The development is expected to open new markets for aluminum strip conductors with adherent organic film insulations and to give electrical manufacturers now using interleaved insulation higher standards of quality without changing their production procedures. Other applications are in transformer windings, lift magnets, automobile horn coils, and vibration inducing devices. Reynolds Metals Co., Richmond 18, Va.

Print No. Ins. 118 on Reader Service Card

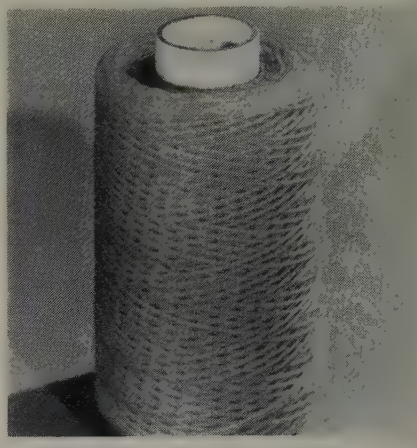
Epoxy/Polyester Insulating Compounds

Compounds for potting, impregnating, molding, encapsulating, and sealing electrical equipment are being offered in both standard compositions and as custom formulations. "Star" compounds are said to be especially suited for treating coil windings, transformers, plug-in sub-assemblies, and all other electrical equipment which require a solid moisture-resistant seal, flame retardancy, and resistance to thermal shock, vibration, oils, acids, and weathering. Encapsulations of coil windings made with the compounds are stated to be especially effective in resisting "terminal pull." The compounds are fluid enough to be poured into molds, and reportedly give good impregnation of windings. They are either polyester-modified epoxies or epoxy-modified polyesters, containing no styrene monomer. The non-corrosive materials can be cured at both elevated and room temperatures, depending on the mixture used. Curing is not inhibited by the presence of rubber, copper, or other substances. The compounds are reported to meet various government and industrial specifications. Acme Wire Co., 1200-1300 Dixwell Ave., New Haven, Conn.

Print No. Ins. 119 on Reader Service Card

Epoxy Impregnated Glass Cord for Electrical Lashing and Holding

A new epoxy impregnated glass cord for electrical lashing and holding applications is called "Scotchply" brand reinforced plastic, type XP-205. The cord is fully impregnated with an uncured high temperature epoxy resin which reportedly prevents glass abrasion and weakening during handling and tying and also thermosets to provide extra toughness and easier bonding. Currently used by one large traction motor manufacturer, XP-205 is applied as a string band on large

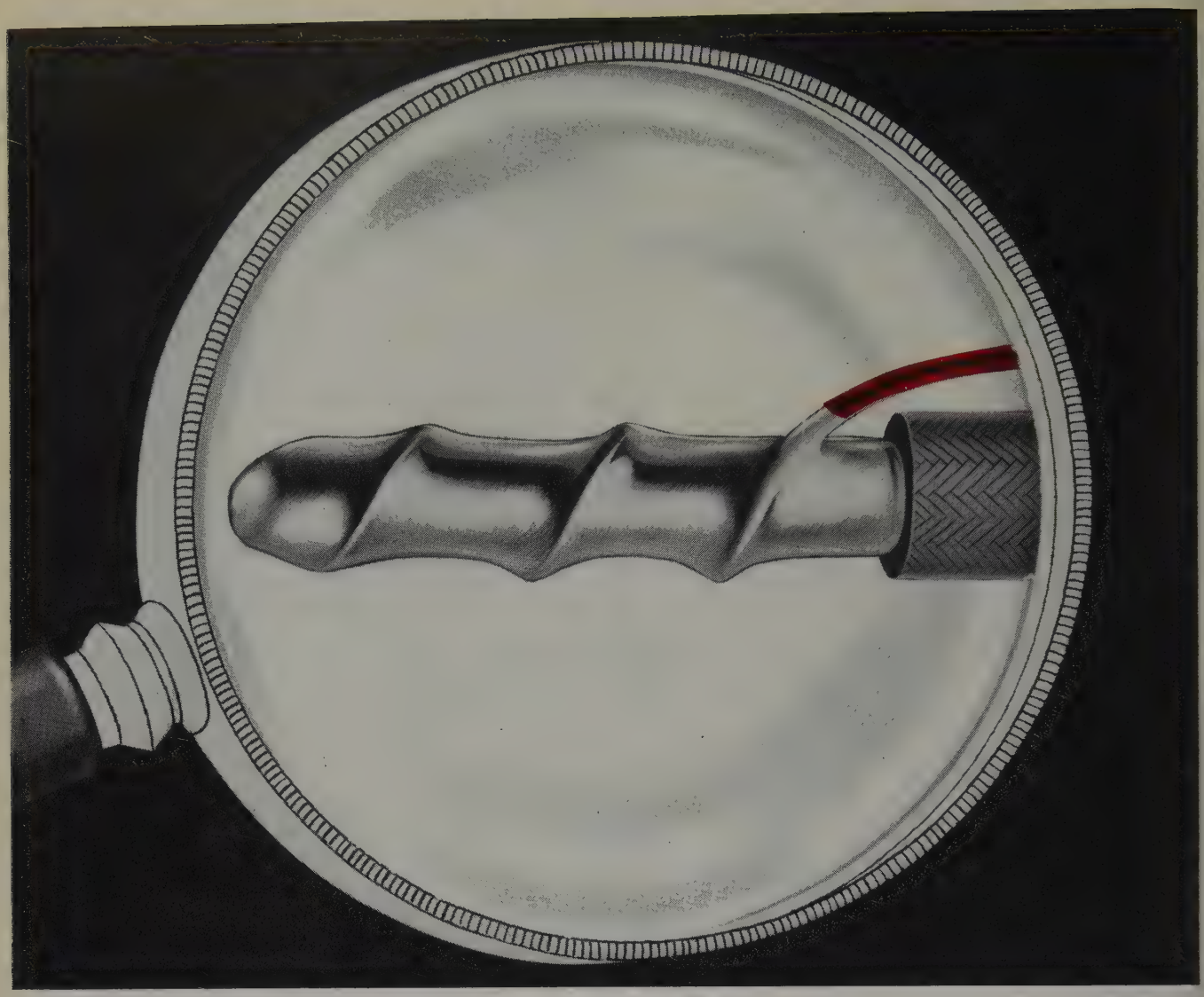


commutators. Other applications include miscellaneous holding and tying applications on motors, generators, transformers, and large coils and substitution for untreated glass cord used by railroad and other rotating equipment repair shops. Properties claimed include a resin content of 26% (±3%); tensile strength of 100 lbs before curing, 210 lbs after curing; arc resistance of 120 seconds; a shelf life of 3 months at 70°F, 6 to 12 months at 40°F; and cures under tension in 3 hrs at 300°F. It is also said to be self-extinguishing. Dept. W1-375, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 120 on Reader Service Card

Two 'Teflon' FEP Resins for Impregnating, Easier Molding

Two new FEP-fluorocarbon resins are Teflon 110, and a water-base dispersion containing approximately 55% FEP solids, "Teflon" 120. Teflon 110 is being manufactured specifically for injection molding of complicated parts such as coil forms, electronic insulators, seals, bushings, and other components requiring close-tolerance design. Easier to mold than the general-purpose Teflon 100, the new FEP resin is said to permit fabrica-



Simplify all your Electrical Connections with Phelps Dodge Solderable Magnet Wires!

Four wires—with low temperature solderability—which permit direct soldering of connections, thus eliminating need for stripping of insulation:

Sodereze®—The Phelps Dodge Polyurethane film with excellent electrical properties. Ideal for layer wound coils, I. F. coils and hundreds of other applications where solderability is required.

Nyleze®—Nylon over Sodereze—Class B. Ideal for random wound coils, armatures, Class B transformers and the difficult winding applications.

Grip-eze®—A special frictional surface over Sodereze which prevents end-turn fall down. Ideal for "basket-weave" and "universal" wound coils.

S-Y Bondeze®—Phelps Dodge self-bonding film over Nyleze. Allows quick and excellent bonding in addition to direct low temperature solderability. Excellent for self-bonded random wound coils.

Reliable electrical connections are assured with these Phelps Dodge solderable wires. Their uniformly high quality permits use on automated, as well as manual soldering lines. When used in either operation, these wires offer important overall time and cost savings benefits.

Magnet Wires that Pace the Industry

PHELPS DODGE COPPER PRODUCTS CORPORATION

INCA MANUFACTURING DIVISION FORT WAYNE, INDIANA

MINE TO MARKET P D

Print Ins. 30 on Reader Service Card

tion of parts having thinner cross-sections with improved quality. "Teflon" 120 is designed for use as a coating impregnant for glass fabrics, yarns, and sleeving. This dispersion of FEP reportedly offers high dielectric strength, long-term, heat-aging stability, minimum permeability to chemicals, and extremely low water absorption. E. I. du Pont de Nemours & Co., Wilmington, Del.

Print No. Ins. 121 on Reader Service Card

Conductive Glass-Reinforced Polyester Molding Compound

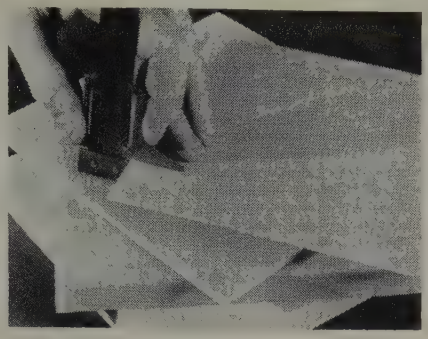
New molding compound of fiber glass-reinforced polyester, designated as grade X-1011-F, reportedly exhibits excellent physical strength and corrosion resistance in addition to complete static electricity draining. The premix material has wide application, especially for explosion-proof equipment. Parts molded of it are said to require little or no subsequent machining and are considerably lighter than metal. They can therefore be used as cost-saving replacements for some cast or machined metal parts, particularly where resistance to corrosion is required. The black material is electrically conductive to the extent

that it will show a zero Megger reading. Physical properties reported are: Impact (IZOD notched), 5 ft lb/in; flexural, 16,000 psi; and tensile, 5,000 psi. Costs range from 63¢ to 69¢ per lb. Engineering-price data and samples available. The Glastic Corp., 4321 Glenridge Road, Cleveland 21, Ohio.

Print No. Ins. 122 on Reader Service Card

Economy Grade Silicone Laminate For Class H Insulating Uses

An economy grade silicone plate, H-9758, has been developed for general applications requiring class "H" insulation temperatures. Possible applications include transformers, barriers, rotating apparatus, coil washers, slot wedges, slot filler strips, coil end turns, spacers, and hangers. H-9758 silicone plate reportedly has excellent electrical properties, high



impact strength (20 ft lb/in for ⅛" thick plate and 25 ft lb/in for ½" plate), and flexural strength (flatwise with grain) of 20,000 psi for ⅛" plate. Machinability is decreased by use of large glass fibers and yarns and by comparatively low bond strength. The material is stated to have a dielectric constant of 4.8 to 4.9 at 1 mc, arc resistance of 180 seconds, surface resistance of 100,000 megohms, and volume resistivity of 10^7 megohm-cm. Costs are approximately 20% under standard grades. Westinghouse Electric Corp., Micarta Div., Hampton, S. C.

Print No. Ins. 123 on Reader Service Card

Asbestos-Base Reinforced Plastics for Rockets, Other High Temperature Uses

Two new reinforced plastics are made with asbestos bases and proprietary phenolic resins. Designated "Tayloron" PA and PA-6, they were developed specifically for use in rocket components and other high temperature applications. The PA material is said to have the best machining properties of all asbestos-base grades of reinforced plastics. Other characteristics claimed are excellent thermal insulation, heat resistance, good ablation performance in a wide temperature range, high tensile and flexural strength, and good impact resistance. It reportedly has demonstrated outstanding char formation of high strength, shown minimum blistering and erosion, and withstood structural stresses. PA-6, made with highly purified asbestos, has thermal and mechanical properties similar to those of PA but has even better ablation properties and exhibits superior strength in continued service at temperatures as high as 500 to 700°F (260 to 371°C). It has been used in components of solid-fuel rocket engines. PA-6 also is reported to show good stability and uniformity and high structural properties both in molded and laminated forms. Both materials are supplied in every form required for rocket components and other high temperature applications. Bulletins available. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 124 on Reader Service Card

Phenolic/Glass Laminates For Use to 800°F

New grade PG-381, a high temperature phenolic resin/glass reinforced laminate, is designed for applications requiring high insulation and high temperature properties. Laminates are available in thicknesses from .125" to .750" and greater. It is said to be produced in accordance with the requirements of Mil-R-9299 (Type II Class 2). Excellent machining characteristics and resistance to temperatures as high as 800°F (427°C) are featured. Technical literature available. The Mica Corp., 4031 Elenda St., Culver City, Calif.

Print No. Ins. 125 on Reader Service Card

Epoxy Resin for Potting Large Masses

A room-temperature curing, semi-flexible epoxy resin system is specially formulated for sealing grounded well junction boxes and explosion-proof fittings, and is also said to be suited for field use in potting condulets and other large electrical fixtures. The epoxy, called "Scotchcast" brand electrical resin No. XR-5046, is a two-part 100% solids system designed for potting or encapsulating in large masses. Because it contains no thinners or solvents, it reportedly cures evenly and free of voids with less than 1% shrinkage. In large masses the resin is stated to cure from the inside out, preventing stresses from pulling the resin away from the walls of the potted object. Low exothermic heat rise during cure is also claimed to aid the potting of large masses without damage to the resin or materials being potted. The two-part resin is packaged in correct proportions for use in shipping containers that are just half-filled so they can be used

for mixing and pouring. High resistance to impact, mechanical and thermal shocks, and abrasion are claimed. The resin is said to be suitable for continuous service between —70°F and +270°F (—56.7 and +132°C) and for periods of exposure up to several hours at temperatures beyond those extremes. Specific gravity of 1.5; viscosity of 25,000 cps, electric strength of 400 vpm, and a pot life of 1 to 2 hrs (depending upon the mass) are also reported. Dept. W1-369, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 126 on Reader Service Card

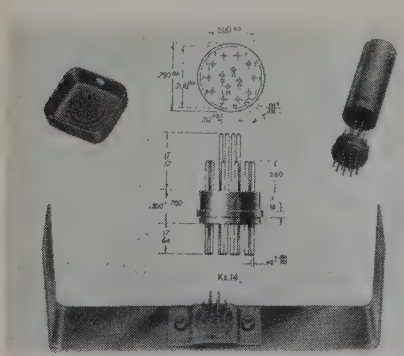
High Temperature Epoxy Impregnating And Casting Compound Has Long Pot Life

New No. 43-21 is a low viscosity epoxy impregnating and casting system specifically conceived to withstand continuous operation for extended periods at temperatures up to 500°F (260°C). It is said to exhibit a heat distortion temperature of 148°C (300°F), and to have a working life of at least four weeks, which makes it ideal for use in vacuum impregnating operations and laminating applications. In addition, 43-21 reportedly displays high-grade electrical properties, moisture resistance, excellent adhesion, and stability against chemical attack. Mereco Products Div., Metachem Resins Corp., 530 Wellington Ave., Cranston 10, R. I.

Print No. Ins. 127 on Reader Service Card

Round Plastic Plug for Relays and Miniature Plug-In Circuit Assemblies

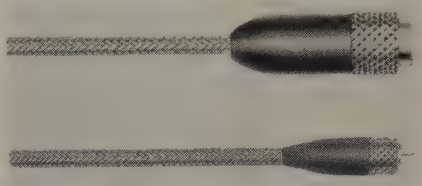
A new 14-pin round plug will be of particular interest to relay manufacturers and also to builders of miniature plug-in circuit assemblies. Designated as K1.14, the plug configuration allows it to mate with TS1405P01 sockets and is molded in mica-filled phenolic with phosphor bronze cadmium plated .040″ diameter pins. Vector Electronic Co., 1100 Flower St., Glendale 1, Calif.



Print No. Ins. 128 on Reader Service Card

Miniature Coax and Triax Cable Assemblies

Newly developed miniature coaxial and triaxial cables and cable assemblies with connectors in 50, 75, and 95 ohm sizes are now available. Standard line includes stranded or solid conductor, "Teflon" insulation, silver-plated shield: extruded or taped

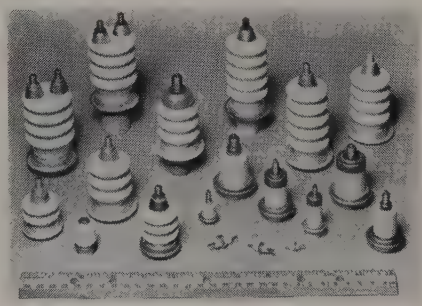


Teflon, and extruded nylon and braided composition jackets. Special constructions include low capacitance and low noise features. Cable assembly connectors mate with standard inter-connecting parts. Boston Insulated Wire & Cable Co., Bay St., Boston 25, Mass.

Print No. Ins. 129 on Reader Service Card

Alumina Ceramic-to-Metal Terminals For Use to 1700°F

A new line of alumina ceramic-to-metal terminals for hermetically sealed electronic equipment is stated to be suitable for service to 1700°F (927°C). The ADVAC alumina terminal line consists of 20 standard sizes



ranging from 5/16″ diameter up to 1½″ diameter. The terminals are rated in accordance with Mil-T-27 specifications and will withstand flashover voltage in excess of 27 kv. The metal hardware is pure silver brazed to the ceramic, and the terminals can be soft soldered, brazed, or welded. They are said to permit a vacuum-tight hermetic seal. Applications include use in equipment such as transformers, capacitors, relays, pulse networks, reactors, delay lines, motors, filters, and switches. Advanced Vacuum Products Inc., subsidiary of Glass-Tite Industries Inc., 430 Fairfield Ave., Stamford, Conn.

Print No. Ins. 130 on Reader Service Card

Tape Protects Fingers in Pigtailing, Transformer Laminating, Other Jobs

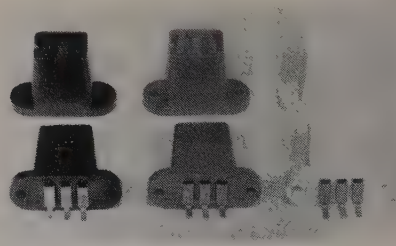
New "Gauztape" is specially prepared for protecting workers' fingers against bruises, burns, and skin injuries. It is claimed to be excellent for use in transformer laminating, pigtailing, etc. The material reportedly sticks only to itself—not the skin—and will not make skin sensitive. It is

also said to be easy to apply and remove and to provide effective protection for a full working day. Finger cots of Gauztape are stated to be as soft as cotton, very flexible, and to have exceptional non-slip qualities. Free sample, bulletin, and prices available. Modern 1st Aid Necessities Co., 737 W. Randolph St., Chicago 6.

Print No. Ins. 131 on Reader Service Card

Transistor Test Sockets

Leakage at 500 volts, room temperature, is said to be less than 1 millimicroamp in new transistor test sockets for use in conjunction with AMP



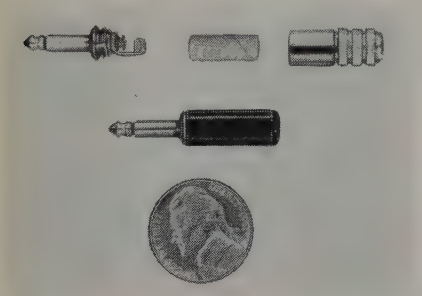
parallel connector No. 34130 which eliminates soldering. Other features cited include: reversible contacts, quickly changed to compensate for wear; elimination of point contact to transistor leads; provisions for for-

eign matter to pass through to prevent false parameters from occurring; ability to withstand 1,000,000 insertions; and three different temperature ranges (TS-187 —300°C, TS-187A —1500°C, and TS-187R —700°C). Atlantis Metal Products Div., Atlantis Electronics Corp., P. O. Box 451, Garland, Texas.

Print No. Ins. 132 on Reader Service Card

Small Two-Conductor Plugs

Miniature two-conductor plug incorporating several new features is made of nickel plated brass parts with tinned terminals. It is available with handles of red or black plastic or nickel plated brass. High voltage tested at 500 vrms. Terminal arrangement includes one clamp sleeve connection and one combination "wrap-around" or "solder-cup" connection. Internal



insulation is of phenolic and "Mylar." The Mylar reportedly has a dielectric strength of 4000 vpm, zero moisture absorption, and is chemically inert, even to most acids. Zoron Inc., 612 W. Monroe St., Chicago.

Print No. Ins. 133 on Reader Service Card

Epoxy/Paper-Base Laminates for Printed Circuits and Terminal Boards

New grades EP-800 and EP-800-T, a flame retardant unclad and a copper-clad epoxy/paper-base laminate, respectively, were developed for applications where reliability, copper-to-laminate bond strength, insulation resistance, and flame retardance are required but cost does not justify the use of glass-base laminates. They were designed specifically for printed cir-

cuitry and terminal board applications. Initial bond strengths with an average minimum of 14 lbs/in for 2 oz copper cladding and 11 lbs/in for 1 oz copper cladding, and minimum blistering time of 30 seconds are claimed. Literature available. The Mica Corp., 4031 Elenda St., Culver City, Calif.

Print No. Ins. 134 on Reader Service Card

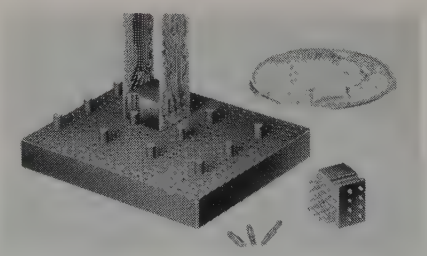
RTV Silicone Rubber for Many Electrical Insulating Uses

Eccosil 4850 is a flexible RTV silicone rubber said to have exceptional electrical and high temperature properties. Ease of use and a temperature capability of 600°F (316°C) for extended periods are claimed for the 100% solids material. Applications include use as a transformer potting compound, as an encapsulant, and as a caulking and sealing compound. Also, flexibility and release characteristics reportedly make it a useful molding compound. Low shrinkage during cure and exceptional dimensional stability are featured. Sample kits and bulletin 13-2-1 are available. Emerson & Cuming Inc., Canton, Mass.

Print No. Ins. 135 on Reader Service Card

Tiny Connector Block With 250 Terminations

A significant step in miniaturization of components for the data proc-

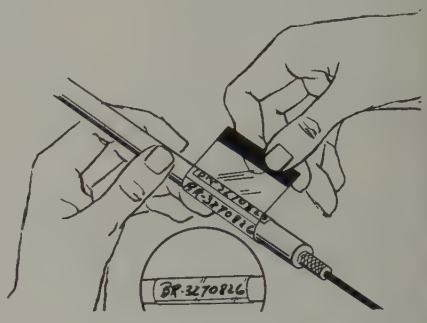


essing field, with applications in airborne and missile units, a new high density micromodule connector has provision for more than 250 terminations within a block approximately 2" x 2¼". In addition, components may be mounted between 32 printed circuit boards. Its small size is expected to permit equipment compactness heretofore not realized with this type of connector. National Connector Corp., Science Industry Center, Minneapolis 27, Minn.

Print No. Ins. 136 on Reader Service Card

Self-Protected, Do-It-Yourself Wire Markers

Codes or legends can be written on-the-spot with new self-laminating write-on wire markers. "Write-On's" are used where requirements call for small quantities of markers of many different special legends. Each self-adhering marker has a protective clear portion which wraps around itself, causing it to laminate perma-



nently over the written code. Markers are said to be especially suitable in prototype operations, R & D, maintenance, or production work. A more permanent adhesive bond around wires is claimed to result because each marker is applied by the tab—not the adhesive. Free samples and color brochure available. Westline E-Z Code Div., Western Lithograph Co., 689 E. 2nd St., Los Angeles 54, Calif.

Print No. Ins. 137 on Reader Service Card

Thixotropic Epoxy Dipping Resin

"Ritecast" #B-3461 is a low-cost ($0.79/lb) epoxy resin dipping compound said to provide a surface coat with excellent thermal shock and moisture resistance on transformers, motors, capacitors, and similar components designed for continuous operation at 135°C. It is applied and cured at room temperature by conventional dip coating procedures to impart a hard, glossy, ceramic-like finish. High thermal conductivity reportedly minimizes heat build-up within a component. Coarse-threaded stainless steel bolts coated with the compound are stated to have been successfully thermal cycled from 135°C to dry-ice temperature without cracking. Wright Plastics Inc., Research and Development Corp., 114-13 Atlantic Ave., Richmond Hills, L. I., N. Y.

Print No. Ins. 138 on Reader Service Card

(*Continued on page* 74)

Heat-Resistant Varnish Solves Bonding Problem in Small High-Speed Motors

An interview with Robert M. Henry, District Sales Manager
Schenectady Varnish Company, Inc., Schenectady, N. Y.

Impregnating varnishes used in more efficient, small high-speed motors must hold the coils rigidly in place despite higher operating temperatures. As described below ISONEL 31 Polyester Varnish shows outstanding bond strength in Helical Coil Bond Test.

Q. What is the significance of the bonding strength of an insulating varnish?

A. In rotating equipment this is a measure of its ability to hold the coils of a motor in place without cracking or losing adhesion—despite severe environmental stresses.

Q. Is there a standard test for this?

A. A number of methods have been devised — splints, bundles, screwhead and Helical Coil are the best known. The latter is relatively new, but is in wider use because it more closely resembles the actual insulating varnish bond in electrical equipment.

Q. Why is bond strength emphasized for the newer small motors?

A. It applies equally to motors of all sizes, of course. In small motors though, as operating temperatures rise, conventional varnishes deteriorate, coils are spun loose at high speeds and failures result. The Helical Coil Bond Test provides reliable data on the ability of a varnish to maintain its bond strength at temperatures of 155 C or more.

Q. Since practically all rotating equipment involves both a magnet wire enamel and an impregnating varnish, is this test useful for both?

A. Yes, considerable data has been accumulated for various varnish/enamel combinations in our Electrical Testing Laboratory, some of which are shown below.

Q. Which combinations seem best suited for small motors?

A. In tests of various magnet wire enamels with a polyester varnish, a polyvinyl acetal enamel showed the highest bond strength. (See Fig. 1). It was closely followed by a polyester enamel.

Q. How about other varnishes?

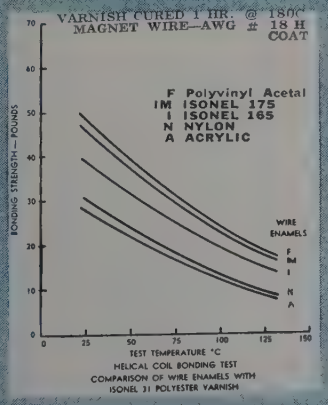
A. Because of their hardness, phenolic varnishes have been used mostly for small high-speed motors. In Fig. 2, however, you see the effect of heat aging on a phenolic vs. our ISONEL* 31 High-Bonding Varnish. Lower to begin with, the polyester increases in bond strength for over 200 hours at 200 C, before bond strength is affected.

Q. What is your conclusion, then?

A. It depends on the application, of course. In general, we believe best results on small motors are obtained with a polyvinyl acetal or polyester enamel with ISONEL 31 Varnish.

** Reg. T. M., Schenectady Varnish Company, Inc.*

DIP-COATER applies ISONEL Varnish to enameled wire samples.



◀ Fig. 1—Comparison of bonding strength of various wire enamels with ISONEL 31 High-Bonding Varnish.

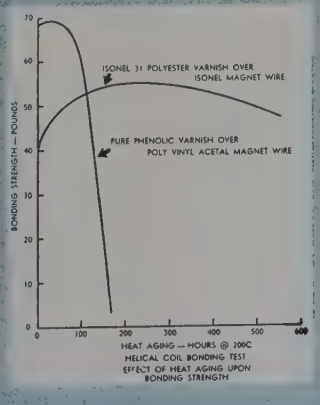


Fig. 2—Effect of heat aging on bonding strength of phenolic varnish and ISONEL 31 High-Bonding Varnish. ▶

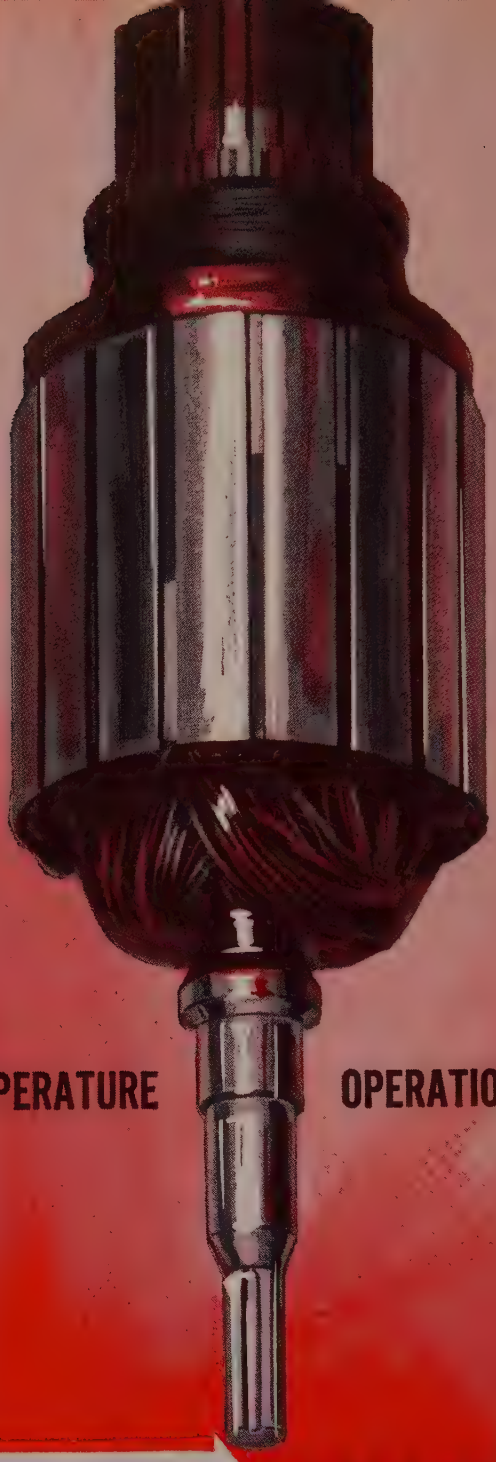
Consult your wire supplier for data on ISONEL enameled wire.

Inquiries should be directed to:
Section E-131

SCHENECTADY VARNISH CO., INC.
SCHENECTADY 1, N. Y.

Insulating Varnishes and Wire Enamels for the Electrical Industry — Since 1906
Other Plants In:
Canada • England • Mexico • France

Print Ins. 32 on Reader Service Card



AFFORDS CONTINUOUS HIGH-TEMPERATURE OPERATION UP TO 250 C

HERE'S NEWS ABOUT ANACONDA M

The exceptional heat stability of Anaconda ML Magnet Wire makes it ideal for electrical equipment operating at continuous high temperatures up to 250 C — such as high-temperature motors, relays and dry-type transformers. This same heat-resistant characteristic also makes ML Magnet Wire a valuable tool in miniaturization and in reducing the size of larger equipment.

Tremendous overload resistance (as demonstrated by thermoplastic flow above 500 C and heat shock resistance over 400 C) makes ML Magnet Wire particularly suitable for portable tool armatures and other applications where "stall" conditions or unusual overloads may be experienced.

Essentially zero weight loss to 200 C makes it possible to ML Magnet Wire for relays that will operate at temperatures to 250 C with low space factor and comparatively low c Using ML Magnet Wire in sealed relays practically elimin contact contamination due to "outgassing" of wire insulat

Other ML Magnet Wire advantages: high burn-out resista and cut-through level; dry dielectric strength over 3,000 V/ excellent flexibility; good windability and scrape resistanc

ML Magnet Wire is coated with a solution of ML Polymer, a chemical development by duPont that represents a tremend improvement in heat resistance over organic coatings.

ESISTS HEAT SHOCK UP TO 425 C

ILM-COATED MAGNET WIRE FOR 220 C

gnet Wire can be used as a replacement for most film-coated gnet wires, except solderable types, and many glass and ss Dacron wires. Where the positive inorganic spacing of ss is required, the combination of ML film and glass serving rs outstanding properties. ML Magnet Wire's combination of h temperature rating, excellent winding characteristics and ce factor permits its use in many applications which formerly uired the use of much more expensive combinations of mics and fluorocarbons.

Magnet Wire is available in all sizes of round, square and angular. Film additions are single, heavy, triple or quadruple knesses, all conforming with NEMA specifications. ML also meets all requirements of Spec. MIL-W-583B for Class 180 Types H, H2, H3, and H4, and Class 200 Types K, K2, K3, and K4. For prices, technical data and applications engineering information, contact Department EFL, Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York.

61269R

ASK THE MAN FROM

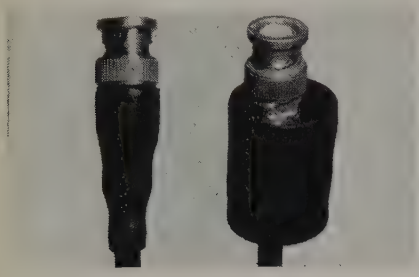
ANACONDA®

FOR ML MAGNET WIRE

Print Ins. 33 on Reader Service Card

Heat Shrinkable Connector Boots

New heat shrinkable "Thermofit" boots for moisture proofing coaxial cable connectors are supplied in an expanded size and shape to be slipped in place after the connector assembly is complete. The boot shrinks around the cable and connector upon exposure to 250°F or above for a few seconds. A completely waterproof seal reportedly can be achieved by the



application of adhesive S-1005. Boot is also said to provide excellent strain relief. Right angle boots can be supplied. Available in modified polyolefin, modified neoprene, or modified silicone rubber. All are stated to have high dielectric strength, to be nontoxic, and to resist melt or flow. Rayclad Tubes Inc., subsidiary of Raychem Corp., Oakside at Northside, Redwood City, Calif.

Print No. Ins. 139 on Reader Service Card

Metal-Clad, Glass-Bonded Mica For Printed Circuits, Switching, Etc.

New metal cladding techniques are said to make available metal-clad "Mykroy" glass-bonded mica which can be used in precision circuitry design. Chief property cited is dimensional stability. Others are no outgassing in vacuum, and resistance to arc, fire, and radiation. The new glass-bonded mica is available in sheets and rods, and as custom-made insulators with finished circuitry. Sample kit containing metal-clad Mykroy, etchants, resists, and instructions is available. Molecular Dielectrics Inc., 101 Clifton Blvd., Clifton, N. J.

Print No. Ins. 140 on Reader Service Card

Room-Curing, Thixotropic Epoxy Resin for Electrical Use

A room-temperature curing, thixotropic, semi-flexible epoxy resin may be used for a variety of electrical insulating, sealing, caulking, and filling applications. Called "Scotchcast" brand resin No. 10, it is a 100% solids system designed for continuous operation at class B (130°F) temperatures. Extreme resistance to mechanical and thermal shock stresses and permanent flexibility, retained even after severe heat aging, are claimed. The resin also features a low exothermic heat rise. It can be applied by extrusion or spatula, and also is said to be suitable for many dipping applications. Objects can be coated by warming and dipping into the resin at room temperature, partially controlling coating thickness by the temperature of the part. Oven heat can be used to speed cure. Specific gravity of 1.52; linear shrinkage of less than 1% during cure; electric strength of 400 vpm, and Shore D hardness of 75 are reported. Dept. W1-464, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 141 on Reader Service Card

Polycarbonate Resin Certified Self-Extinguishing by UL

"Merlon" polycarbonate resin reportedly has been certified and listed as a self-extinguishing material in the Group II category by Underwriters' Laboratories Inc. Polycarbonate is said to be the only commercially-available thermoplastic material known that combines the self-extinquishing property with transparency, high impact resistance, and dimensional stability. Mobay Chemical Co., Penn-Lincoln Parkway West, Pittsburgh 5, Pa.

Print No. Ins. 142 on Reader Service Card

Adapter for Connecting Flat Cable To Conventional Round Wire

An adapter device for interconnecting flat conductor cable with conventional round wire is used to terminate

flat cable runs at conventional terminal boards or strips, and facilitates flat cable runs where the ultimate termination is to round wire. The new connector reportedly makes the use of flat conductor cable a practical reality for low voltage control wiring, intercom systems, and remote control wiring. Bulletin P3-57 available. The Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

Print No. Ins. 143 on Reader Service Card

Colored, Transparent Epoxy Potting And Encapsulating Compounds

New series of epoxy potting and encapsulating compounds reportedly combine the advantages of easily identifiable colors and complete transparency, thus allowing both color coding and viewing of embedded components, regardless of casting size. Available in yellow, orange, red, blue, violet, green, and turquoise transparent colors. Series EPC 100 potting and encapsulating compounds are available with a tailor-made curing system. Compounds are said to cure with low shrinkage to yield products of superior physical and electrical properties that will withstand both thermal cycling (Mil-T-27A) and high heat distortion temperature. Techform Laboratories Inc., 332 Sunset Ave., Venice, Calif.

Print No. Ins. 144 on Reader Service Card

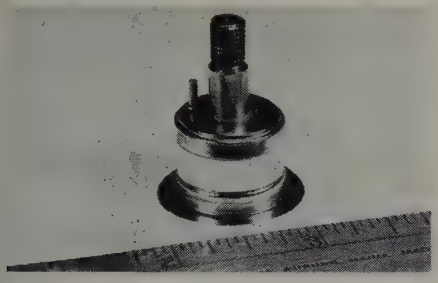
'Teflon' Coated Metals and Laminates For Insulating and Printed Circuits

Two new types of insulating and printed circuit materials, both called "Amfoil," consist of "Teflon" coated foils and laminates of metal foils with glass fiber paper "Tissuglas." The first type is aluminum or copper foil coated with Teflon. The Teflon coating is from 0.00006″ to 0.005″ thick on a foil 0.0002″ to 0.005″ thick. The primary uses for this type are expected to be for electrical equipment and as a mold release. The second type is a laminate—claimed to be the thinnest and most flexible printed circuit material now available with an

operating temperature of over 300°F (149°C). One laminate consists of one mil thickness of Tissuglas (matted submicron glass fibers) and ¾ mil thickness copper with 400 v dielectric strength. Amflex Products Dept., American Machine & Foundry Co., 261 Madison Ave., New York 16.
Print No. Ins. 145 on Reader Service Card

High-Alumina Semi-Conductor Housings for Vacuum-Tight, 350°C Use

New high-alumina semi-conductor housings feature a ceramic-metal bond that reportedly remains high-vacuum-tight during continuous operation at 350°C in air. The bond is chemical, rather than mechanical, and is formed by a variation of the active alloy process. The bond and high-alumina ceramic are said to give



the new housings two major advantages over hermetic glass types: high-vacuum tightness and greater crack resistance over a wider range of mechanical and thermal stresses. Some housings are stated to have remained high-vacuum-tight after repeated direct transfer from liquid nitrogen at —196°C to molten solder at 240°C. The high-alumina housings are also claimed to permit longer creepage paths in a compact design than practical to form with glass. Ceramaseal Inc., New Lebanon Center, N. Y.
Print No. Ins. 146 on Reader Service Card

'Teflon' FEP/Nylon Hook-Up Wire

Designed to meet a broad range of temperature, electrical, and physical problems in the electronic data processing and appliance industries, "Turbotemp" Teflon FEP/nylon wire is a tin coated solid copper hook-up wire insulated with fluorinated ethylene propylene (Teflon FEP) and jacketed with nylon. It is claimed to be the most reliable product available for automatic wire wrap terminations and to be suitable for continuous

operation over a temperature range of −55°C to +120°C at 300 v rms. Low capacitance and low dielectric constant, with minimum change over a wide range of frequency and temperature conditions, are also reported. Available in continuous length up to 6,000′, with solid color primary insulation and clear nylon jacket, or natural color primary insulation and pigmented nylon jacket. Also, white primary insulation is available with one or two color tracers applied either on a primary insulation (under the jacket) or applied to the outer nylon covering. It is drum packed to minimize wire set problems. Brand-Rex Div., American Enka Corp., 31 Sudbury Rd., Concord, Mass.

Print No. Ins. 147 on Reader Service Card

Low-Cost, High-Strength Epoxy Adhesive Features Equal Part Mix by Volume

New room-temperature-curing epoxy adhesive formulated for high-strength industrial use, "Bondmaster" M666, is a two-component system which is mixed in equal parts by volume. The mixed adhesive is said to be free-flowing, and may be applied

with spatula, trowel, paint roller, knife, brush, or standard two-part epoxy spray equipment. Red color provides a visual check on coverage. Fully cured metal-to-metal bonds produced with this new product, tested at room temperature using Mil-A-5090B procedures, are reported to yield up to 3,500 psi. Bonds involving expanded styrene foam reportedly withstand 175°F for 200 hrs without cell attack. Material is reported to be priced at ⅓ to ½ less than most conventional formulations of equivalent strength. Rubber & Asbestos Corp., Department P, 225 Belleville Ave., Bloomfield, N. J.

Print No. Ins. 148 on Reader Service Card

New Stable Polyester Film for Many Electrical Insulating Uses

Terafilm, a new plastic film made of "Tenite" polyester, is described as a remarkably strong, durable, highly transparent and brilliant film which is exceptionally stable under conditions of high temperature, frequency, and humidity, and especially suitable for a broad range of electrical applications. Principal uses reported in the electrical field are for cable and wire insulation, capacitors, coils, slot liners, and wire. High insulation resistance and greater hydrolytic stability than currently available in polyester films are reported. Resistance to the damaging effects of water vapor, solvents and alkalies is also characterized as outstanding. Terafilm Corp., Canal & Ludlow Sts., Stamford, Conn.

Print No. Ins. 149 on Reader Service Card

Low-Density Polyethylene for Tough, Smooth Line Wire Coverings

A new low-density polyethylene extrusion compound said to have exceptionally high stress-cracking resistance, "Bakelite" DFD-0745 Blk 9845, is designed for use on line wire, service drop cable, and other applications that require superior resistance to weathering and other stresses. Tensile strength of 2300 psi, elongation of 600%, brittle temperature of −85°F, zero deformation at 105°C and only 15% at 110°C, are other properties reported. Outstanding electrical properties and thinner, smoother coatings are also claimed. Union Carbide Plastics Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17.

Print No. Ins. 150 on Reader Service Card

Heat-Shrinkable 'Dacron'-Epoxy Tubing

A new heat-shrinkable Dacron-epoxy tubing developed for slip ring applications is intended to provide

simple and precise slip ring positioning and to eliminate the close-tolerance machining operations that are generally necessary for the press-fitted slip rings. It is also intended to eliminate the alternative practice of fitting slip rings by splitting and then bonding the segments to provide increased strength for the slip ring structure. Typical shrinkage rates for the new tubing—grade HY 418—are said to be exemplified by tubing with 1″ ID which shrinks 0.030″ to 0.050″ when heated to 150°C for 10 minutes and allowed to cool to room temperature. Other features reported include tensile strength of 8500 psi, compressive strength of 17,200 psi, water absorption of 0.18%, and dielectric strength of 407 vpm. Micarta Div., Westinghouse Electric Corp., Hampton, S. C.

Print No. Ins. 151 on Reader Service Card

Ethylene-Propylene Rubber for Electrical Applications

A new synthetic rubber, designated "Enjay" EPR (ethylene-propylene rubber) is now available at an introductory price of 26 cents per pound, fob plant in carload lots. It reportedly possesses outstanding resistance to ozone, weathering, and chemicals and is expected to attract strong interest in the electrical industry. Enjay Chemical Co., Div. of Humble Oil & Refining Co., 15 West 51st St., New York 19.

Print No. Ins. 152 on Reader Service Card

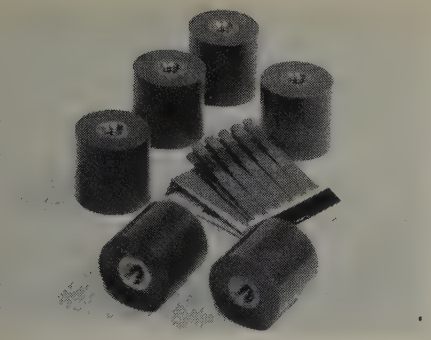
Dry Powder Epoxy Casting Compound

A new one-component, epoxy-based material in dry powder form is designed for easy handling in potting applications. "Dri-Cast" reportedly has outstanding electrical characteristics and exceptionally high thermal conductivity. Its extremely low shrinkage and low coefficient of thermal expansion are said to approach inorganic materials in value. Thermal and physical shock properties are also reported excellent. Bulletin DPE-13 available. Hysol Corp., Olean, N. Y.

Print No. Ins. 153 on Reader Service Card

Flame Retardant, Track Resistant Panel Board Insulators

New insulator for panel and switch boards said to combine flame retard-



ance, carbon tracking resistance, and the toughness characteristics of fiber glass reinforced polyester is designed for NEMA and UL applications of up to 600 v. The 1" high, 1" diameter standoff insulator is molded of "Resistrac" fiber glass alumina polyester compound. It is claimed to have 1000 times greater carbon tracking resistance than a comparable phenolic insulator. The insulators are 100% hi-pot tested at 5,000 v. Engineering-price data and samples available. The Glastic Corp., 4321 Glenridge Road, Cleveland 21, Ohio.

Print No. Ins. 154 on Reader Service Card

Improved Protective Insulator Coating

A new fluid carrier which permits an enriched mixture with up to 30% more grease by weight to "Insuljel," a protective silicone insulator coating, is said to permit application of the same coating thickness of grease to insulators in less time, and with less total volume of material handled. Faster evaporation of vehicle and improved spraying qualities are also cited. Insulator Dept., General Electric Co., P. O. Box 57, Baltimore 3, Md.

Print No. Ins. 155 on Reader Service Card

'Teflon' FEP Insulated Wire

Type K, KK, and KT wire insulated with Teflon 100 FEP in accordance with Mil W-16878D is now available. Unusual electrical properties, exceptional heat resistance with operating ranges up to 200°C, chemical inertness, low permeability, toughness and strength, excellent weatherability, non-adhesiveness, ice release, transparency, low friction, and low moisture absorption are claimed. Phalo Plastics Corp., Shrewsbury, Mass.

Print No. Ins. 156 on Reader Service Card

Pixilated Patents

By Mike Rivise

Fifty-ninth in a series of odd and interesting inventions in the electronics field from the files of the U. S. Patent Office.

●

The illustration shows what may have been the grand-daddy of present-day electric vibrator lounge chairs (now always illustrated with some slender young lovely who does not appear to need reduction—or expansion—in any dimension). It was patented by Carl O. Lindstrom of Chicago in 1909.

The invention relates to "electro-vibratory apparatus used in the treatment of diseases, and has for its object to provide a simple and convenient combination of parts whereby a chair or seat occupied by the patient has imparted to it a rapid vibratory movement which in turn is imparted to the patient."

In the illustration, 1 represents a chair or seat, 2 is the electro-vibrator, 3 is a battery or other source of supply, and 4 is a clamp adapted for engagement with any desired part of the chair or seat. At each end of the clamp are angular jambs 5 and 6 through one of which passes the clamping screw 7 by which the clamp is secured to the desired part of the chair, 8 are a pair of segmental wire jaws attached at one end to the body portion of the clamp in a pivotal manner, while the other ends of the jaws are provided with eyes for the passage of a clamping screw 9, by means of which the jaws are firmly clamped around the body of the electro-vibrator.

As stated in the patent, "In use the vibrator imparts a rapid vibratory movement to the chair or seat, which movement in turn is imparted to the patient occupying the seat, and has been found from extensive use to afford good curative effects in the treatment of many types of nervous and other diseases."

Apparently this unit could be attached to any suitable chair. This greatly interested an acquaintance of ours. It seems he had a specific application in mind . . . a certain rocking chair located in our nation's capital.

Fig. 1.

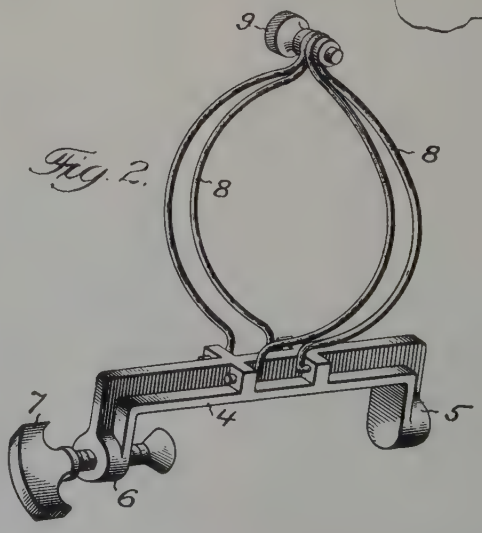


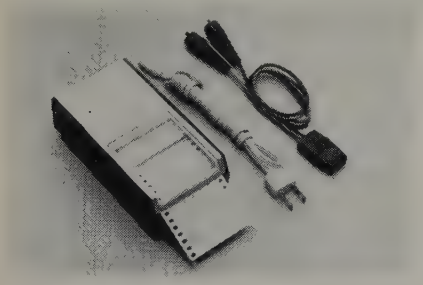
Fig. 2.

New Instruments and Equipment

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card —no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Miniature Recording Voltmeter

New recording voltmeter will make a legible, permanent record on a moving paper tape (2½″ x 35′). It features simplified paper loading, expanded scale, and miniature size. The recorder is only slightly larger than a panel meter (3-1/16″ x 5⅝″ x 1-11/16″; 20 ozs). It is said to be sensitive, completely portable, and

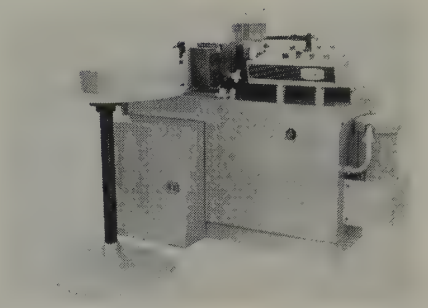


easy to operate. The unit is available, complete with leather carrying case, line cord, and test probes, in two models: regular scale (0/150/300/-600 v a-c) and with an expanded scale (95 to 130, 190 to 260 v a-c). Regular scale models list for $79.85; expanded-scale models for $84.85. Amprobe Instrument Corp., 630 Merrick Road, Lynbrook, N.Y.

Print No. Ins. 201 on Reader Service Card

Large and Small Stator Slot Liners Inserted Automatically in One Cycle

Dual cuffed stator slot cell inserter will insert both large and small cuffed slot liners in the same cycle. Model SCM-45-2V is reported to insert up to 150 slot cells per minute—either square or round bottom. The cuffed liner inserter rolls a cuff edge into the paper, feeds and cuts it, forms it into shape, and inserts the formed insulation into the slot. Then it indexes automatically, selecting either small or large slots in sequence, repeats the



operation until all the slots in the stator are filled, and stops automatically. An expanding mandrel clamps the stator to the machine. It can be adjusted for any stack height up to 4½″ by changing the width of the insulation paper used. The inserter accepts stators with up to 7″ inside diameter—larger stators with machine modification. Possis Machine Corp., 825 Rhode Island Ave. S., Minneapolis 26, Minn.

Print No. Ins. 202 on Reader Service Card

Electro-Hot Air Welding Tools For Thermoplastic Materials

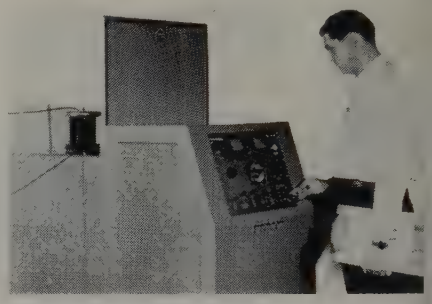
New addition to a line of electro-hot air welding tools which are designed for rapid, low cost welding of vinyls, polyethylene, and other thermoplastic materials, the Model LPS weighing only 1 lb is said to be ideally suited for both experimental work and for regular production welding. Air can be supplied by a regular compressed air system or by special radial blowers. Among the many features claimed are a plug-in heating element

which provides for extremely high temperatures and is easily replaceable; a switch in the handle to change the temperature range, while fine temperature adjustments are possible through control of air intake; and a built-in thermostat for safety should the tool be connected without an air supply. The tool is supplied with non-corrosive vinyl air hose and extra nozzles and is priced at $49.50. Available for both 110 v and 220 v operation. Weldotron Corp., 907-R Frelinghuysen Ave., Newark, N.J.

Print No. Ins. 203 on Reader Service Card

Heavy Duty A-C Breakdown Tester Designed for Safety Engineering

A new high voltage a-c breakdown test set has been designed for the requirements of safety engineering applications such as insulation tests of gloves, lineman's tools, and mobile work towers, as well as for testing a wide range of electrical equipment including cables, bushings, switchgear, transformers, and motors. The model 4950 A-C "Hypot" provides test potential continuously adjustable

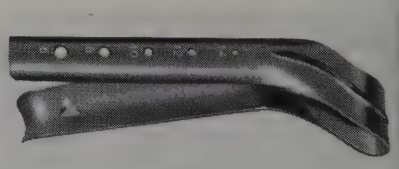


from zero to 60 kv and is rated at 20 kva. The output voltage rise may be automatically controlled at any rate from 300 to 3000 v/sec. The dwell time, at selected maximum test voltage, can be set for periods of up to 15 minutes. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.

Print No. Ins. 204 on Reader Service Card

NM Plastic Jacketed Cable Ripper

The outer covering of the new type NM plastic jacketed cable is said to be readily slit with a new cable ripper. It is claimed that this new tool, catalog No. Hi-225, also rips all sizes of braided non-metallic sheathed cable without harming the insulation



of individual wires. The tool is made of steel, is 5¼″ long, and formed to conveniently fit the hand. The cable is slipped into the tool from the side. A press of the thumb causes a case hardened point to pierce the jacket,

nd a straight-away pull slits it to end f cable. Price is 43¢. Holub Industries Inc., Sycamore, Ill.

Print No. Ins. 205 on Reader Service Card

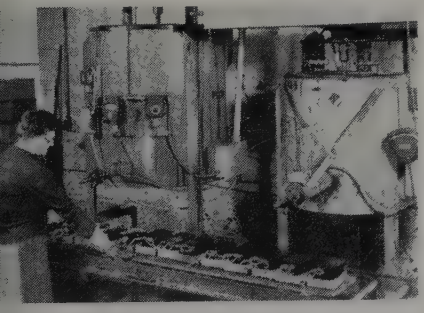
arge Volume, Low Gradient emperature Chamber

Large volume, low gradient temperature chamber, model 1060B, reportedly has temperature profile characteristics suitable for Mil. Spec. testing of large assemblies where temperature variation throughout the specimen, including gradient, control variations, and drift is not to exceed ±1°C. Test volume is approximately 5 cu ft. Special fixtures are available for testing large quantities of small components for quality control type test runs. Temperature range is −100°F to +500°F (−73.3°C to 260°C). Unit may be automatically cycled between two temperatures. Delta Design Inc., 3163 Adams Ave., San Diego 16, Calif.

Print No. Ins. 206 on Reader Service Card

nsulation Compound Melters For Transformer Manufacture

Electrically heated and thermostatically controlled compound melters are used to melt insulation material used in manufacture of transformers. The units are equipped with electrically heated draw-off valves which dispense the compound into transformer cases,



thus bonding the element, and with a mechanical agitator for proper mixture. Sta-Warm Electric Co., a subsidiary of Wakefield Corp., Ravenna, Ohio.

Print No. Ins. 207 on Reader Service Card

Device Measures and Controls Temperature

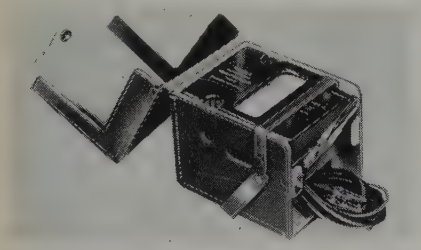
A new infrared industrial pyrometer no larger than a hand movie camera is said to accurately pinpoint remote temperature. It is designed to cover the industrial infrared wave

length spectrum of from 1-12 microns. High sensitivity and fast response reportedly enable it to measure and control the temperature of any size object, whether the target is stationary or moving at various speeds. The new "Servotherm" pyrometer is stated to be ideal for application wherever surfaces do not permit physical contact, with moving objects, with tiny targets, for high speed measurements, and for measurements in hazardous, noxious, or other adverse environments. Servo Corp. of America, 111 New South Rd., Hicksville, N.Y.

Print No. Ins. 208 on Reader Service Card

Improved Insulation Tester

Improved, pocket-size "Megger" insulation tester, the Mark III with a constant voltage hand generator, is said to provide steady testing voltage

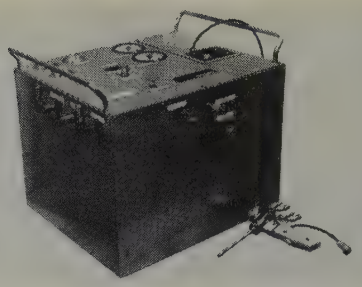


without dependence on batteries or other current supply. Three ranges of instruments are available: 100 v d-c, 0.02-20 megohms; 250 v d-c, 0.05-50 megohms; 500 v d-c, 0.1-100 megohms. Each of these models is also available with a double scale and selector switch for 0-10,000 ohms. The single scale, 500 v model is suited for testing house wiring, domestic appliances, portable tools, etc., operating on 115 and 230 v. The 250 and 100 v instruments are for lower voltage circuits. James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.

Print No. Ins. 209 on Reader Service Card

Rigid Urethane Foaming Machine

A new rigid urethane foaming machine, the Viking Mark III-A and IV-A, is stated to offer accurate reproducible ratio settings. Annular pumps reportedly permit calibration of every machine to NAFIL formulations. The user simply dials lbs/min foam flow rate, which eliminates weighing components and constant metering checks. The Viking Mark V spray or pour head is claimed to be self-cleaning, whether use is constant



or intermittent, and to have a dwell time of up to 4 hrs between shots. A lever movement changes from pour to spray and vice-versa. The machine is 25″ long, 22″ wide, and 19″ high. It weighs 175 lbs. Chase Chemical Corp., 3527 Smallman St., Pittsburgh 1, Pa.

Print No. Ins. 210 on Reader Service Card

Rotary Wire Stripper

Model 79 swing blade rotary wire stripper is designed for the convenient stripping of wires where it is difficult to bring the wire to a bench-type wire stripper, e.g., wires projecting from large panels, cabinets, air frames, heavy harnesses, bulky multi-conductor cables, etc. It is said to strip extruded or wrapped insulations, including "Teflon" without nicking the conductor and to leave stranded conductors firmly twisted for termination. The complete unit weighs 7½ lbs. The hand piece weighs 12 ozs and is 1⅛″ diameter. Catalog form 132 available. Carpenter Mfg. Co. Inc., P.O. Box 217, Dewitt 14, N.Y.

Print No. Ins. 211 on Reader Service Card

Resin Gun Mixes and Sprays Two Component Resin Systems

A new unit for mixing and dispensing reactive resins and hardeners, called the "Turvort" head, has been incorporated into a gun weighing less than a pound. When equipped with proper spray tips, it can do airless spraying of multicomponent resin

materials. Design is said to eliminate the need for solvent purging. Trigger action gun permits convenient spraying of urethane foam resin materials, liquid epoxy resins, liquid polyester resins, and many other materials when equipped with an appropriate metering system to supply materials in the proper proportions. The Leal Corp., P.O. Box 53, Oaklyn, N.J.

Print No. Ins. 212 on Reader Service Card

Automatic Vacuum Systems Control

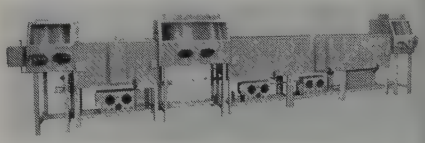
A device which functions like a radio alarm clock can be used to control or protect the operation of industrial vacuum systems. Called "Protectovac," the 10-lb unit automatically maintains any preselected level of

pressure from 40 to 1000 microns for vacuum furnaces, coaters, and pumping systems. The unit is said to offer savings in equipment maintenance and product quality control. Price is $375. NRC Equipment Corp., subsidiary of National Research Corp., 160 Charlemont St., Newton 61, Mass.

Print No. Ins. 213 on Reader Service Card

Controlled Environment System For Baking Electronic Parts

A controlled environment system incorporating a new type of conveyorized oven can be adapted to the manufacture of a wide variety of electronic



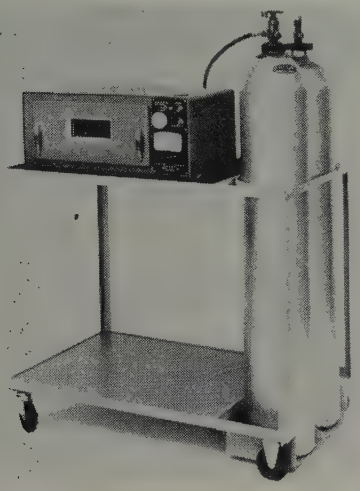
components. Heart of the controlled atmosphere system is an infra-ray conveyor oven said to be capable of baking out impurities by focusing heat directly on component parts and heating them to within ½°F of the desired temperature. The system consists of three controlled atmosphere assembly enclosures and two infra-ray ovens. Temperature Engineering Corp., Riverton, N.J.

Print No. Ins. 214 on Reader Service Card

Temperature Testing Center

A convenient, movable test stand

designed to centralize temperature tests in one area has a 24″ x 30″ rubberized working surface which will accommodate a series of portable temperature chambers. It also has a



similar size storage shelf beneath the unit. Provisions are made for the storage of two 50-lb bottles of liquid CO_2 used in conjunction with the temperature chambers. Delta Design Inc., 3163 Adams Ave., San Diego 16, Calif.

Print No. Ins. 215 on Reader Service Card

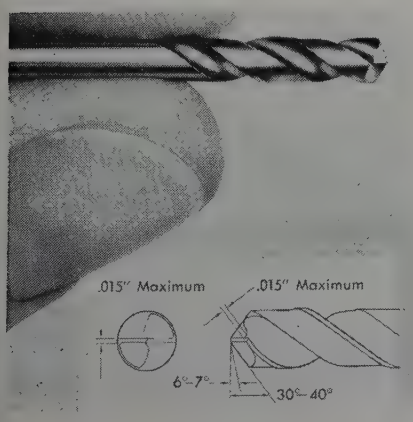
Sonic Gun for Defoaming, Degassing, Mixing, and Dispensing

Instantaneous ultrasonic defoaming, degassing, mixing, and dispersing in pipe lines or tanks is possible with a Sonic Gun. It reportedly is effective in high or low density solutions, and is unaffected by extreme hot or cold temperatures or operating pressures. Price is $300. Ultrasonic Industries Inc., Ames Court, Engineers Hill, Plainview, L.I., N.Y.

Print No. Ins. 216 on Reader Service Card

Carbide Drills for Printed Circuit Boards

A new standard line of solid carbide drills is designed primarily for



use in stack drilling printed circuit boards on various high production type machines. Designated series 362-N, the new drills feature a 118°-120° included point angle, with primary and secondary lip relief angles of 6°-7° and 30°-40° respectively. These factors—plus the drills' .015" maximum webb at the point—reportedly permit fast, accurate drilling of smooth, burr-free holes in epoxy and phenolic laminates. In addition, all drills in the new line are said to be finished with highly polished flutes and strong, sharp edges to assure a faster, cleaner cutting action, high resistance to wear, and longer tool life. Ace Drill Corp., Adrian, Mich.
Print No. Ins. 217 on Reader Service Card

Batch Ovens for Treating Insulation

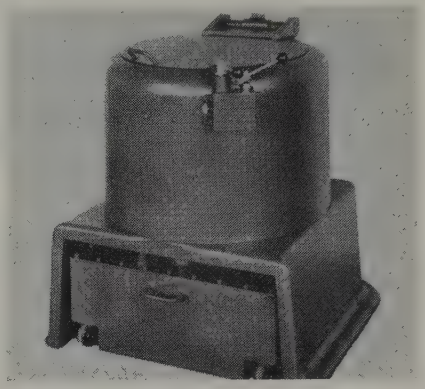
Mechanical convection, horizontal airflow, industrial batch ovens are available in two temperature ranges: to 356°F (180°C) and to 600°F (316°C), the ovens are used for general aging, curing, drying, preheating tempering, coil and armature baking, core baking, synthetic finish baking, and many similar procedures. Indicating/controlling thermostat reportedly provides quick reading and setting of oven temperature. Six standard sizes are available from 16 to 96 cu ft. Blue M Electric Co., 138th & Chatham St., Blue Island, Ill.
Print No. Ins. 218 on Reader Service Card

Accessories for Vacuum Evaporators

New accessories for commercial vacuum evaporator systems consist of precision machined collars to fit between the bell jar and the baseplate of a vacuum system. Collars can be supplied for 6", 12", 14", 18", or 24" bell jars, and have a large number of feed-through ports. Each 2" diameter port has a flat pad with four mounting studs and is designed to take any standard VTI flanged feedthrough. These include feed-throughs for high and low voltages and current; cooling water; RF heating; ionization, discharge, and thermocouple gauges; etc. Collar/baseplate combinations as one-piece assemblies are also available. A first range of standard chambers has also been designed to be used with the new 6", 8-port collars. Equipment Div., Vacuum Technology Inc., P.O. Box 3125, Van Nuys, Calif.
Print No. Ins. 219 on Reader Service Card

Air-Powered Centrifugal Coater

A completely air-powered centrifugal coater applies many types of coatings to small parts. Use of air power reportedly provides several advantages. Units comply with safety codes and provide full control over film thickness of almost any type of



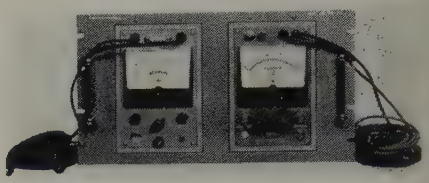
coating. Although these coaters were designed primarily for paints and lacquers, they can safely handle baking enamels, air-drying enamels, synthetic paints, liquid waxes, lubricants, rust inhibitors, and many other types of new plastics films. The Leon J. Barrett Co., P.O. Box 378, Worcester, Mass.
Print No. Ins. 220 on Reader Service Card

Temperature-Humidity Chamber Uses Liquid CO_2 Refrigeration

New temperature-humidity test chamber has no mechanical refrigeration system either for low temperature or dehumidity conditions. The Econ-O-Line low-high temperature humidity chamber (model ELHH-4-LC) has internal working dimensions of 18" by 18" by 18" and contains no mechanical components. The test chamber utilizes liquid CO_2 refrigeration to pull temperature down as far as —100°F and to control humidity in the 20 to 95% RH range. High temperature range is +350°F. The chamber is furnished with a 2 pen-2 cam programming recording controller for complete documentation of its performance. Price is $2,675. Associated Testing Laboratories Inc., Wayne, N.J.
Print No. Ins. 221 on Reader Service Card

Insulation Breakdown and Leakage Tests Combined in One Instrument

Both high voltage breakdown tests and insulation leakage measurements may be made with the model 8527



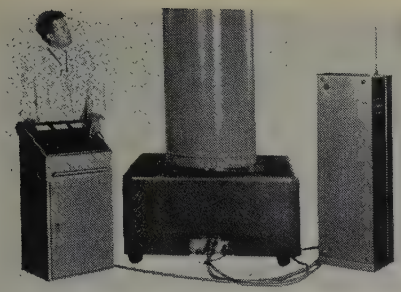
test set. The "Hypot" section provides a-c potential that is continuously variable from zero to 1.5 kv for breakdown testing, with separate read-out lights to indicate breakdown and leakage current above a preset value. Other models are available with higher a-c test potentials or with d-c test potentials. The "Vibrotest" megohmmeter section measures insulation resistance to 50,000 megohms. Models are available for measuring insulation resistance to five million megohms. The instrument may be supplied for mounting in a standard 19" rack or in a bench-type metal cabinet. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.
Print No. Ins. 222 on Reader Service Card

Machine Marks 'Teflon' and Other Thin-Wall Insulations

New KW-7 machines mark insulated electrical wires with the circuit code reference identification of each wire. Use of letter-numeral coding on single-color wire is said to reduce wire inventory problems, speed production, and reduce wire harness preparation costs. Latest improvements reportedly enable marking of various new wire coverings, including Teflon and thin-wall insulations to military and commercial requirements. Kingsley Machine Co., 850 Cahuenga Blvd., Hollywood 38, Calif.
Print No. Ins. 223 on Reader Service Card

Electrostatic Generators for Cable and Insulation Testing

The new electrostatic generators, models AK600-4 and AKS600-4, are said to be designed for applications where accuracy and close regulation of output voltage are critical. Rated at 600 kv, 4 ma, the power supplies can be utilized for many industrial and research applications including cable and insulation testing. Both

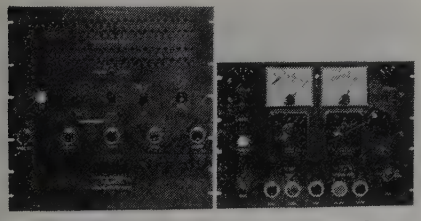


units reportedly provide essentially pure d-c output, infinitely variable voltages to 600 kv, and safety features which include low output capacitance, minimal short circuit and overload currents, and remote adjustment and shutdown. Input voltage for each model is three phase, 220/380 v, 60 cps standard, with 50 cps optional. The generators are designed in three modules so that the control and electronic sections (low voltage) may be remotely located from the high voltage section. Total weight is under 2400 lbs. SAMES, 30 Broad St., New York 4.

Print No. Ins. 224 on Reader Service Card

Automatic Capacitor Tester Has Alarm, Failure Memory

An automatic capacitor test set to sequentially measure leakage current in as many as 50 capacitors and provide a record of failures, model 8515, is equipped with panel lights to indicate the unit under test. A memory light signals the failure of a unit, and remains illuminated as the automatic test sequence continues. Fixtures may also be employed to test other components, assemblies, and cables with



up to 50 conductors. Unit supplies a d-c potential continuously adjustable from 0 to 20 kv for capacitor testing. A motorized control raises the test potential at the rate of 300 v/second to any pre-set value, and then returns to zero. The leakage current measurement ranges are 0-10 to 0-250 microamperes. The heavy duty power supply provides a charging current of 20 milliamperes for rapid testing of capacitors. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.

Print No. Ins. 225 on Reader Service Card

New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that the literature can be sent to you promptly.*

Plastics Products Brochure

New brochure outlines services and products offered in the laminated, fabricated, and molded laminated plastic fields. Illustrated are printed circuits and intricately machined mili-

tary parts, as well as sturdy molded laminated parts. Brochure also describes manufacturing, quality control methods, and research facilities. 12 pages. The Richardson Co., 2634 Lake St., Melrose Park, Ill.
Print No. Ins. 301 on Reader Service Card

Electro-Mechanical Insulation Tubing Bulletin

New bulletin compares test results on an electro-mechanical insulation tubing composed of continuous filament woven glass fabric grade with a phenolic binder with competitive tubing. Complete specifications and electrical applications are listed. A table of decimal equivalents is also given. 4 pages. United Fiberglass Co., 4001 N. W. 24th St., Miami 42, Fla.
Print No. Ins. 302 on Reader Service Card

Silicone Fluids Reference

New, comprehensive technical reference describes the broad range of major silicone fluids used as dielectrics, as additives in urethane foams, and for many other applications. Designated S-9, the publication includes a physical data summary chart, which permits easy identification of major grades of materials available, and a silicone fluid selector, in which available silicone fluid grades are identified by major application areas. 20 pages. Silicone Products Dept., General Electric Co., Waterford, N.Y.
Print No. Ins. 303 on Reader Service Card

Bulletin on New Epoxy Molding Compound

New sales/service bulletin 1501-8-1 describes new epoxy molding compounds developed for high speed, high volume, automated molding operations. It outlines molding methods, mold design, and applications, and illustrates typical procedures with the new material under actual production conditions. 4 pages. American-Marietta Co., 3400 13th Ave., Southwest, Seattle 4, Wash.
Print No. Ins. 304 on Reader Service Card

Bulletin on "Teflon"-Lined Rubber Tubing

Teflon-lined rubber tubing for transmitting electrical and electronic cabling and for other applications where protection to the Teflon is required to prevent kinking or abrading in service is illustrated and described in new bulletin No. 1-RR. Advantages of a Teflon-neoprene combination and standard sizes of tubing available are given. 2 pages. Pennsylvania Fluorocarbon Co. Inc., 1115 North 38th St., Philadelphia 4, Pa.
Print No. Ins. 305 on Reader Service Card

Spec Sheets For Insulation Papers

Standard specification sheets and a listing of physical and chemical test methods for kraft and glassine electrical insulating papers are available. The specification sheets show such characteristics as caliper, density, conducting particles, moisture content, dielectric strength, ash content, pH water extract, basis weight, and coverage. 5 pages, Dept. Pl-381, Paper Products Div., Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.
Print No. Ins. 306 on Reader Service Card

Brochure on New Facility For Silicone Molding Compounds

New customer service facility offering complete engineering service to end users and fabricators of parts made from silicone molding compounds is described and illustrated in brochure No. 7-604. 8 pages. Dept. WTR, Dow Corning Corp., Midland, Mich.
Print No. Ins. 307 on Reader Service Card

Catalog of Diamond Tools For Cutting Ceramics

A new catalog of diamond wheels and diamond hones contains general information on diamond wheels, recommended starting specifications for a wide variety of work, prices, and a section on wheels for silicon and germanium cutting. Norton Co., Worcester 6, Mass.
Print No. Ins. 308 on Reader Service Card

Folder on Modular Terminal Panel Wiring Block

New folder details complete specifications on a new modular terminal panel wiring block, trademarked "Termi-blok," which is designed to replace barrier boards and terminal boards in switchboards, control panels, industrial instrumentation, and other applications. Advantages, dimensions, and test data are given. 4 pages. AMP Inc., Eisenhower Blvd., Harrisburg, Pa.
Print No. Ins. 309 on Reader Service Card

Report on Extrusion of Polypropylene Monofilament

Monofilament extrusion with a polypropylene is comprehensively discussed in Technical Report No. 6. Report also examines electrical and physical properties of polypropylene monofilament and describes the var-

THE INSULATION CHALLENGE . . .

A Complacency-Shattering Exclusive Editorial Milestone in the February Issue of Insulation!

Once again, *Insulation* leads the way with a memorable series of articles in the February 1962 issue which will shock, interest, and challenge its readers. Developed around the theme of "The Insulation Challenge," these articles will tell readers where insulation technology stands today and where it has to get to in a hurry if this country is to meet the crucial domestic and world-wide challenges which face us. Whether it is a washing machine motor or a missile, the problems are acute, and these articles will pinpoint our insulation shortcomings and attributes. *Insulation's* February conference issue will do more than just give complete conference information, it will set an editorial pace that will serve as a publication value measurement for years to come. It presents a significant advertising opportunity for your firm to explain how it is meeting the challenge. Titles and authors for this series are shown below:

Why the Challenge Must Be Met, *Dr. Wernher von Braun,* Supervisory Physical Scientist, Director, George C. Marshall Space Flight Center, National Aeronautics and Space Administration.

The Design Challenge, *K. N. Mathes,* Insulation System Engineer, General Engineering Laboratory, General Electric Co.

The Reliability Challenge, *R. B. Feuchtbaum,* Member of Technical Staff, Materials and Processes Section, Hughes Aircraft Co.

The Molecular Research Challenge, *R. B. Young,* Research and Development, Insulating Materials Department, General Electric Co.

The Training Challenge, *M. L. Manning,* Dean of Engineering, South Dakota State College.

The Testing Challenge, *Harold Miller,* Vice President, Engineering, Associated Research Inc.

The Standards Challenge, *Dr. Arnold H. Scott,* Physicist, Dielectrics Section, Electricity Division, National Bureau of Standards.

The Radiation Challenge, *V. J. Linnenbom,* Head, Radiation Effects Branch, Radiation Division, U. S. Naval Research Laboratory.

The High Temperature Challenge, Battelle Memorial Institute.

The Cryogenics Challenge, *Joel H. Lieb,* Engineering Specialist, Materials Engineering, Chemical Unit, and *Robert E. Mowers,* Research Engineer, Rocketdyne, A Division of North American Aviation Inc.

The Chemical and Moisture Resistance Challenge, *H. R. Sheppard,* Manager, Chemical Application Section, Materials Laboratories, Westinghouse Electric Corp.

The Electrical Challenge, *M. L. Manning,* Dean of Engineering, South Dakota State College.

The Mechanical Challenge, *J. R. Huntsberger,* Fabrics and Finishes Department, Research Division, Experimental Station, E. I. du Pont de Nemours & Co.

REASONS FOR ADVERTISING IN THE SPECIAL FEBRUARY CONFERENCE ISSUE OF INSULATION

• *Editorial Support*—there will be tremendous editorial support for your advertising in the February issue of *Insulation. First,* it will be referred to constantly during the conference because it will give complete details on the program, exhibits, tours, points of interest, luncheons, banquets, and other conference highlights. *Second,* the February issue will feature a series of 13 exclusive, high interest articles developed around the theme of "The Insulation Challenge" (see above). A star-studded cast of expert, well-known authors are preparing these articles—the February issue will be saved for reference purposes for years to come.

• *Bonus Circulation*—free copies of the February issue will be distributed to the thousands of registrants at the conference. You get this bonus circulation at no extra advertising charge! What's more, you get the benefits of *Insulation's* 22,000 plus regular circulation—the only subscription list of insulation users in the world with readers who are qualified on the basis of their interest in electrical/electronic insulation—and nearly every subscriber has been personally verified with better than 96% of the subscriptions addressed to a specific *name and title.*

• *Stature and Spokesman for the Industry*—because of the valuable communications contributions *Insulation* has made, it has achieved unequalled stature and is recognized as the spokesman for the insulation user industry. This preeminence is associated with your company when you advertise in *Insulation.* The prestige of *Insulation* has been enhanced by its pioneering editorial efforts and its donation of the Golden Omega Award to the conference for presentation to such technological leaders as Vice Admiral Hyman Rickover, USN, of nuclear submarine fame, and Dr. Mervin J. Kelly, who had so much to do with the development of the transistor.

• *Effective, Waste-Free Devotion to the Interests of Your Customers*—only *Insulation* concentrates exclusively on serving the insulation design users and buyers in the electrical/electronic industries who are your potential customers. This waste-free circulation and editorial which is not duplicated elsewhere means that your advertising can be completely effective.

Make sure you speak to all your potential customers at the Electrical Insulation Conference with dominant advertising in the February issue of Insulation. *Ask for complete media and market data file.*

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ious steps involved in its production. 16 pages. Plastics Div., Eastman Chemical Products Inc., subsidiary of Eastman Kodak Co., Kingsport, Tenn.

Print No. Ins. 310 on Reader Service Card

Bulletin on Silicone Rubber For Wire and Cable

New bulletin S-4 describes the various silicone rubber compounds now available for use as wire and cable insulation. In addition to tables showing typical properties and suggestions for handling compounds, the publication also contains illustrations showing typical constructions and applications. An added feature is a section on silicone rubber gums available for fabricator mixing. 8 pages. Silicone Products Dept., General Electric Co., Waterford, N.Y.

Print No. Ins. 311 on Reader Service Card

Bulletin on 'Teflon' Products And Fabricating

Specialization in Teflon fluorocarbon resin products is featured in new bulletin R3017. Illustrations show many products and processing operations on this resin and on formulations containing reinforcing agents, including new X-seal rings and conventional products such as O-rings, back-up rings, packings, molded parts, extrusions, and machined parts. 8 pages. Allegheny Plastics Inc., Rt. 51 and Thorn Run Rd., Coraopolis, Pa.

Print No. Ins. 312 on Reader Service Card

Bulletins on Stator Insulating, Winding, and Lacing Machines

Two new brochures describe a line of stator insulating, winding, and lacing machines. Equipment is fully illustrated, and specifications are given. 8 pages each. Erinac Equipment Corp., 225 Lafayette St., New York 12.

Print No. Ins. 313 on Reader Service Card

Price Schedule for ABS Resins

New schedule gives latest prices for ABS polymers, including three new formulations, for molding, extruding, and vacuum forming. 6 pages. Marbon Chemical Div., Borg-Warner Corp., Washington, W.Va.

Print No. Ins. 314 on Reader Service Card

Guide to Selection of Gas And Electric Infrared Ovens

A guide to the use of gas and electric infrared ovens for heating, drying, and curing details savings possible in many applications. It also considers design factors, illustrates ovens used for plastic fusing, conveyorized tray drying of powders, adhesive drying, metal pre-heating, armature repair, finishing, and lists other applications. 6 pages. Infra-Red Systems Inc., 240 Route 23, Riverdale, N.J.

Print No. Ins. 315 on Reader Service Card

Booklet Gives Properties and Applications for Acetal Plastic

New booklet describes electrical and other properties and applications of "Delrin" acetal plastic. Design factors (including strength and toughness), dimensional stability, resistance to solvents, fabricating and finishing of both molded and machined parts, and use in electrical applications are covered. A summary table of properties according to standard ASTM tests is included. 24 pages. Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich.

Print No. Ins. 316 on Reader Service Card

Metallized Ceramics Bulletin

Comprehensive bulletin No. 612 contains a table of properties of ceramic compositions frequently used as metallized or ceramic-metal adjoinments. It also covers high and low temperature metallizing methods, electroplating, and design and installation instructions for ceramic-metal assemblies. Hermetic terminal products available are listed and illustrated. 16 pages. American Lava Corp., Chattanooga 5, Tenn.

Print No. Ins. 317 on Reader Service Card

Bulletin on Test Probe Receptacles For Printed Circuit Boards

Complete specifications, electrical and mechanical characteristics, and other features of a new line of test probe receptacles used to test probe printed board circuitry are given in new bulletin number 474. It gives details for both two-leg and three-leg receptacles. 2 pages. AMP Inc., Harrisburg, Pa.

Print No. Ins. 318 on Reader Service Card

Epoxy Electrical Resins Selector

Revised electrical resins selector brochure is an easy-to-read guide to insulating resins and their uses for potting, encapsulating, and coating electrical and electronic products, parts, and assemblies. A property chart covers rigid and flexible epoxy potting resins, thixotropic dipping pastes, and varnishes. Among new materials included are two liquid, flexible epoxy resins suitable for class H operation. Indicated for each resin in the listing are temperature class and thermal properties, physical and mechanical properties, pot life, type and proportion of hardener, and curing method. The selector also summarizes each resin system's outstanding features, notes applications for which various resin groups are suitable, and illustrates uses. 4 pages. Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N.Y.

Print No. Ins. 319 on Reader Service Card

Capacitor Test Bulletin

Bulletin 61-03 describes new Type No. 61 automatic capacitor test set for measuring tantalum and electrolytic capacitors in the range of 0.1 μf to 11,000 μf at 0.5 volts RMS at 120 cycles. 2 pages. Barnes Development Co., 213 West Baltimore Ave., Lansdowne, Pa.

Print No. Ins. 320 on Reader Service Card

Brochure on Applications for Reinforced Fiberglass

New brochure outlines the many and varied applications of reinforced fiberglass in industry. It compares product with other popular fabricating materials and sets down specific advantages to be gained by using reinforced fiberglass. Photographs of recent applications comprise a major part of the new brochure. Glastronics, 699 Tarkiln Hill Rd., New Bedford, Mass.

Print No. Ins. 321 on Reader Service Card

Build-In Meters Catalog

New catalog covering a complete line of build-in instruments gives complete details on miniaturized panel-mounting d-c and a-c VTVM's and TRVM's and offers the engineer "designers guide" information for including build-in instruments in end equipment. The information given includes fundamentals of range selec-

tion, scale plate selection, and principles and applications of the phase sensitive voltmeter. Trio Laboratories, Plainview, Long Island, N.Y.

Print No. Ins. 322 on Reader Service Card

Polyvinyl Acetate Manual of Properties and Applications

Comprehensive technical manual divided into four sections contains detailed specifications and physical characteristics on all homopolymer and copolymer polyvinyl acetate resins, emulsions, solutions and spray-dried powders. It also provides data on applications and contains formulations for selected applications. 40 pages. Shawinigan Resins Corp., Dept. RH, Springfield 2, Mass.

Print No. Ins. 323 on Reader Service Card

Bulletin on Plasticizers In Protective Coatings

The plasticizing of resin coatings is covered from acrylics to zein in technical bulletin No. PL-327. Titled "Plasticizers in Protective Coatings," the new reference contains more than 150 suggested starting formulations for 19 different types of cellulosic, rubber, vinyl, and other resin coatings. There are also 10 tables of comparative evaluations of plasticizers in as many different coating systems. Write to Organic Chemicals Div., Monsanto Chemical Co., 800 N. Lindbergh Blvd., St. Louis 66, Mo.

Bulletin on Laminated Epoxy Sheets, Rods, and Tubes

New technical data on a line of laminated epoxy sheets, rods, and tubes, including typical electrical and mechanical properties, sizes, and thicknesses, is contained in bulletin 11,200B. 5 pages. Continental-Diamond Fibre Corp., Newark, Del.

Print No. Ins. 324 on Reader Service Card

Guide for Designing with Phenolic Molding Compounds

New illustrated folder CDC-394 gives guidelines for designing with phenolic molding compounds. It lists typical electrical and other applications and design properties of these materials and compares costs. Chemical Materials Dept., General Electric Co., One Plastics Ave., Pittsfield, Mass.

Print No. Ins. 325 on Reader Service Card

Print Ins. 42 on Reader Service Card

Booklet on Cable Support Systems

New booklet number 106 on cable support systems is designed to help select and install the right section, type of bend, or component part for supporting power cables, communication cables, and automatic control or hydraulic line cables. Illustrations and descriptions show how (without the use of bolts, nuts, washers, or pins) each component piece becomes a part of both simple and complicated cable support installations. 52 pages. Chalfant Products Co. Inc., 11525 Madison Ave., Cleveland 2, Ohio.
Print No. Ins. 330 on Reader Service Card

Electronic Component Catalog

Electronic components illustrated and described in new condensed catalog include tip plugs, jacks, test prods, binding posts, alligator clips, and 11 types of molded terminal blocks. 6 pages. National Tel-Tronics Corp., 52 St. Casimir Ave., Yonkers, N.Y.
Print No. Ins. 331 on Reader Service Card

Price Schedule for Small Quantities of Nylon Fasteners

New price schedule lists hundreds of nylon fastener items (machine screws, hex nuts, washers, screw insulators) available in experimental and pilot model quantities (as few as 10 of a size). Supplier will ship orders as small as $3. 3 pages. Machine Parts Supply Co., 13 East 37th St., New York 16.
Print No. Ins. 332 on Reader Service Card

Solderless Terminal Block Brochure

A new line of solderless terminal blocks for electronic equipment is described and illustrated in brochure K2-5. The boards are designed to function in audio, control, video, and pulse circuits. Cost and space saving features are detailed. 4 pages. The Thomas & Betts Co., 36 Butler St., Elizabeth, N.J.
Print No. Ins. 333 on Reader Service Card

Guide to Molding RTV Silicone Rubber

Revised guide on the use of RTV (room temperature vulcanizing) liquid silicone rubber for model reproduction and plastic tooling, designated CDS-191, gives step-by-step details. Illustrated publication includes two pages of money-saving ideas on mold-making. Special techniques, including the use of pressure casting for the reproduction of finely detailed parts are featured. Also included is a measuring guide for mixing catalyst. 8 pages. Silicone Products Dept., General Electric Co., Waterford, N.Y.
Print No. Ins. 334 on Reader Service Card

Control Cable Catalog

New catalog gives complete data on "Bronco" multi-conductor electrical cables used in control circuits. A chart showing the NEMA code color sequence for control cables, 1 to 60 conductors, is included. 30 pages. Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 58, Calif.
Print No. Ins. 335 on Reader Service Card

Hermetic Sealed Connector Bulletin

New bulletin TI-3 covers a series of super-hermetic sealed connectors, the TI series, designed for high temperature (1200°F), pressure (10,000 psi), vacuum-seal (2 x 10^{-8} cc/He/sec), and requirements of nuclear environments (low cross-section capture) in airborne vehicles, missiles, and electronic and atomic power industries. 4 pages. Physical Sciences Corp., affiliate of Packard-Bell Electronics, 389 No. Fair Oaks Ave., Pasadena, Calif.
Print No. Ins. 336 on Reader Service Card

Data Sheet on Ceramic-to-Metal Housings for Semiconductor Rectifiers

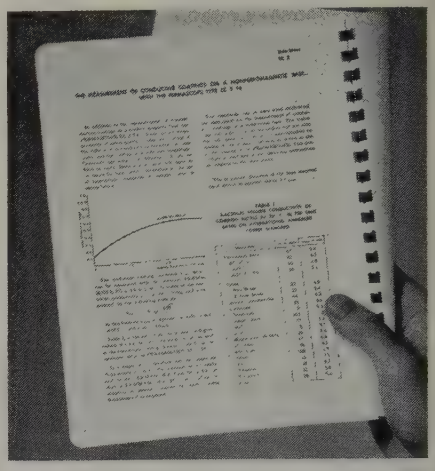
Data sheet AV-100 describes ceramic-to-metal housings for high-power, high-current, semiconductor rectifiers. Bulletin lists advantages of the housings and complete electrical and mechanical properties of the high alumina ceramic used. 2 pages. Advanced Vacuum Products Inc., 430 Fairfield Ave., Stamford, Conn.
Print No. Ins. 337 on Reader Service Card

Folder on Environmental Test Equipment

New folder illustrates a complete line of standard environmental test equipment. Dimensions, temperature ranges, and other engineering data are given for temperature, altitude, and humidity chambers, salt spray and fungus chambers, combined environment simulators, and other testing equipment. 16 pages. Environmental Engineering Div., Bethlehem Corp., 225 W. 2nd St., Bethlehem, Pa.
Print No. Ins. 338 on Reader Service Card

Brochure Presents Tester for Gaging Insulating Coatings on Aluminum and Copper

A new brochure introduces the Type EC Permascope for non-destructive measurement of a non-conductive coating on a non-ferrous base metal such as aluminum or copper and for other uses. It contains descriptive



information, specifications, and prices, plus a technical discussion of non-destructive thickness testing. Twin City Testing Corp., 533 So. Niagara St., Tonawanda, N.Y.
Print No. Ins. 339 on Reader Service Card

Catalog Lists Wide Variety of Coatings, Sealants, and Adhesives

A new catalog listing properties, applications, and various industrial uses of coatings, sealants, and adhesives covers over 80 products in detail, with examples of new uses for many of the items in the electrical/electronic and other fields. 8 pages. Magichemical Co., Brockton, Mass.
Print No. Ins. 340 on Reader Service Card

Catalog Aids Selection of Wire Terminal or Splice

New catalog enables users to determine what terminal or splice barrel size must be used to accept any given size of solid, stranded, rectangular, or square wire (singly or in combination) from No. 26 to 1,000,000 CM. Separate charts define the computations necessary to determine circular mil area of the various forms of wire in cross section; another series of charts equate circular mil area with terminal or splice size. A stud hole chart permits the user to match stud

sizes and dimensions with the stud-hole sizes of various devices. 8 pages. AMP Inc., Eisenhower Blvd., Harrisburg, Pa.

Print No. Ins. 341 on Reader Service Card

Testing News Bulletin

Bulletin on testing methods and equipment used in various industries includes mention of ASTM D1822-61T test for tensile impact energy necessary to break plastics and electric insulating materials. A copy of the ASTM Tentative Method and a specification sheet on the test apparatus are offered. Data is also offered on tension measurement of tapes, wires, thread, coils, condensers, etc. Two papers by Dr. Erwin J. Saxl are mentioned: "Some Fundamental Properties of Matter as Related to the Measurement and Control of Wire Tension" and "Tension in Coil and Tape Winding." 4 pages. Testing Machines Inc., 72 Jericho Turnpike, Mineola, N.Y.

Print No. Ins. 342 on Reader Service Card

Brochure on Color-Coding Plastics

Illustrated brochure, titled "How To Color Code Plastic Parts At Low Cost," explains in detail the many useful applications of a plastics dyeing process for color coding, prototypes, and special effects. It contains a listing of various plastics, their trade designation, and the dyeing process that can be applied to the material, and elaborates on the advantages and economies of the process with brief discussions of typical applications. Color coding when utilizing "family" molds is also discussed. Colorite Industrial Dyers, 589 Eighth Ave., New York 18.

Print No. Ins. 343 on Reader Service Card

Insulating Materials Product Bulletin

New product bulletin 42 covers a comprehensive list of bar glazed insulating papers, transformer boards, resin encapsulated cellulose fiber sheet materials, "Orlon" fiber-acrylic resin paper, polyester fiber-epoxy resin paper, and asbestos fiber reinforced phenolic laminates. Typical test values and standard forms and sizes are given for each. Fabricated parts, slit coils, and coated stock made from these materials are also illustrated and described. 16 pages. Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6.

Print No. Ins. 344 on Reader Service Card

Brochure on Polyester-Glass Insulated Magnet Wire

New brochure describes magnet wires insulated with a combination of "Dacron" polyester and glass fibers called "Daglas." Electrical, physical, chemical, and thermal properties are given and applications and specifications are listed. Tables give dimensions for various constructions. 12 pages. Phelps Dodge Copper Products Corp., Inca Mfg. Div., Fort Wayne 1, Ind.

Print No. Ins. 345 on Reader Service Card

Electrical Tape Catalog

The entire "Slipknot" and "Plymouth" line of electrical tapes is shown in full color in a new illustrated catalog. This short-form catalog is complete with laboratory specifications and property data. Friction tape; rubber and plastic tapes; vinyl electrical tape for all-temperature use with an application range of —14° to +180°F; filler tape, a molding putty-like rubber tape for insulating around connectors; and neoprene splicing compound for oil-resistant applications are covered. 8 pages. Tape Div., Plymouth Rubber Co. Inc., Canton, Mass.

Print No. Ins. 346 on Reader Service Card

Bulletin on Polycarbonate for Electrical/Electronic Applications

Illustrated brochure discusses the advantages of "Lexan" polycarbonate resin for electrical and electronic components. Designated CDC-397, it gives complete technical data on electrical properties, details physical properties, and describes typical applications. 6 pages. Chemical Materials Dept., General Electric Co., One Plastics Ave., Pittsfield, Mass.

Print No. Ins. 347 on Reader Service Card

Bulletin Describes Light Nylon-Base Reinforced Plastic

"Tayloron" PN, a nylon-base laminated plastic which is recommended for rocket applications where temperatures may exceed 4000°F, is described in bulletin 8.9. Characteristics listed include physical, thermal,

and erosion properties; dielectric strength, and machinability. Forms available are also listed. 2 pages. Taylor Fibre Co., Norristown, Pa.
Print No. Ins. 348 on Reader Service Card

Mica Product Brochure

New mica product brochure No. 27 introduces a new design service to manufacturers regarding the potential use or the more effective use of mica in applications of every description. Forms of manufactured mica are described and plant facilities and research and development laboratories are illustrated. One section deals with specially-developed adhesives used in the manufacture of various mica products. 16 pages. The Macallen Co. Inc., Newmarket, N.H.
Print No. Ins. 349 on Reader Service Card

Folder on Copper-Clad Insulating Materials

New brochure describes the grades, production technique, and quality control of copper-clad insulating materials. Characteristics of all materials (including six flame-resistant grades), NEMA tolerances, and a review of new production and quality control systems are included. Spaulding Fibre Co. Inc., 310 Wheeler St., Tonawanda, N.Y.
Print No. Ins. 350 on Reader Service Card

Data Sheets on Epoxy Compounds, Adhesives, and Varnishes

New data sheets cover each of three clear baking varnishes (polyester modified phenolic resins), three epoxy resins, an epoxy adhesive, an epoxy dipping compound for stators, and an epoxy dipping compound for coils and transformers. Also included are detailed selection guides for epoxy resins and for class F varnishes. 22 pages. John C. Dolph Co., Monmouth Junction, N.J.
Print No. Ins. 351 on Reader Service Card

Bulletin on Corona Testers, Detectors, and Pickup Networks

New bulletin 4-10.27 gives complete data on a new line of integrated corona test sets, corona-free high voltage testers, corona detectors, and corona pickup networks. 4 pages. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.
Print No. Ins. 352 on Reader Service Card

New High Dielectric Sealing Compound Described in Bulletin

A new heavy duty electrical insulation material, called "Volseal," is described in bulletin EL-65A as a permanently plastic rubber based compound made with inert and inorganic fillers. Bulletin recommends it for electrical sealing and insulating in heavy industry, describes and illustrates methods of applying it, and contains a table of electrical and other properties. It is coded for AIA filing. 2 pages. Johns-Manville, 22 East 40th St., New York 16.
Print No. Ins. 353 on Reader Service Card

Test Procedures Reference Manual For Film Coated Magnet Wires

New manual of test procedures for all film coated magnet wire types is a compilation and summary of all the different NEMA and MIL-W-583B specification testing techniques that apply. While all of the test procedures described are covered in part by various individual specifications, this is the first time that they have been published in a single easy-to-use source. 6 pages. Hudson Wire Co., Magnet Wire Div., Winsted, Conn.
Print No. Ins. 354 on Reader Service Card

Cable Clamp Data Sheet And Price List

New price lists and data sheets are available for insulated neoprene-dipped cable clamps and plain aluminum cable clamps. 2 pages. Richco Plastic Co., 3722 W. North Ave., Chicago 47.
Print No. Ins. 355 on Reader Service Card

Facts About Plastics

Pocket-sized booklet compares outstanding properties and typical industrial applications of 13 major plastic families in common industrial use. Included are acrylic, nylon, "Teflon," polyethylene, flexible and rigid vinyl, cellulose acetate, butyrate, polystyrene, high and medium impact styrene, phenolic and fibrous glass reinforced polyesters and epoxies. Others are "Mylar," ABS, and acetal. Five major misconceptions about plastics are corrected. 6 pages. Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich.
Print No. Ins. 356 on Reader Service Card

Property and Application Guide for Contact Cleaner and Preservative

New technical guide, bulletin No. C-200, discusses properties and applications of materials which may be used as lubricants, anti-corrosive agents, cleaners, and preservatives for electrical contacts. Insulation properties are tabulated. 6 pages. Craig Laboratories Inc., 46 Stanwood Rd., New Hyde Park, L.I., N.Y.
Print No. Ins. 357 on Reader Service Card

Bulletin on Asbestos-Base Reinforced Plastic for Rockets

Properties of "Tayloron" PA and PA-6, new high-temperature asbestos-base reinforced plastics developed for rocket applications, are given in bulletins 8.4 and 8.5. Machining, thermal insulation, heat resistance, ablation performance, tensile and flexural strength, and impact strength are among characteristics listed. Sizes are given for various forms supplied, including laminated sheet, molded rod, molded tube, rolled tube, molded shapes, and molding forms. 2 pages and 4 pages. Taylor Fibre Co., Norristown, Pa.
Print No. Ins. 358 on Reader Service Card

Property Chart of Plastic and Ceramic Stock Insulations

New chart with photographs of end-products tabulates plastic and ceramic rod and sheet stock insulations. A great variety of material is shown, ranging from standard copolystyrene rod through adjusted dielectric rod and sheet to foam materials in different forms. Physical and electrical properties are completely tabulated with curves plotted as a function of varying dielectric constant. End products are shown. Emerson & Cuming Inc., Canton, Mass.
Print No. Ins. 359 on Reader Service Card

Bulletin on Use of DAP Monomer In Polyester Resin Systems

How, when, and why diallyl phthalate monomer (DAP) can be used in polyester resin systems is the subject of new technical bulletin No. 36. It also outlines the application of DAP as a carrier to introduce catalysts, pigments, and other additives into styrene/polyester. Included is a detailed discussion of the monomer's

contribution to handling properties. End property benefits are outlined, and the bulletin is illustrated with a detailed table and charts on properties and performance. 16 pages. Dapon Dept., FMC Corp., 161 East 42nd St., New York 17.

Print No. Ins. 360 on Reader Service Card

Catalog of ABS Polymers

New catalog contains basic information on nine major grades of ABS polymers. Properties of new grades B, X7, and SF, are presented. Performance advantages, electrical properties, and other characteristics are listed. Many applications are shown. Chart provides data on typical properties of the various material grades, 8 pages. Marbon Chemical Div., Borg-Warner Corp., Washington, W. Va.

Print No. Ins. 361 on Reader Service Card

Batch Oven Bulletin

New bulletin 1961 covers specifications of a line of batch ovens for use in aging, curing, drying, coil and armature baking, preheating plastics, core baking, silicone baking, and transformer tests. 4 pages. Blue M Electric Co., 138th & Chatham St., Blue Island, Ill.

Print No. Ins. 362 on Reader Service Card

Charts Give Dielectric Properties of Foam

Two new charts in color with photos show the properties and uses of a variety of standard foam products. A tabulation of dielectric and physical properties of artificial and adjusted dielectric constant foams is also presented. Foam sheets, both rigid and flexible, as well as a number of foam-in-place and pack-in-place synthetic foams are described. Emerson & Cuming Inc., Canton, Mass.

Print No. Ins. 363 on Reader Service Card

Catalog of Materials for Fiber Glass Reinforced Plastics

Catalog and price list of materials for fibrous glass reinforced plastics includes complete ranges of fiber glass fabrics and fibers, polyester and epoxy resins and catalysts, parting agents, pigments and other necessary supplies. Three pages of property tables and application data are included. 16 pages. Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich.

Print No. Ins. 364 on Reader Service Card

Bulletin on Two Lines of Stacking Station Post Insulators

Bulletin TIA-184 describes the construction and features of two new lines of stacking station post insulators rated from 550 to 1470 kv. It gives detailed information on metal-polymer seal, and includes photographs, line and cutaway drawings, and a table of characteristics of standard, high strength, and extra high strength insulators. 4 pages. General Electric Co., Schenectady 5, N.Y.

Print No. Ins. 365 on Reader Service Card

Data Sheet on Dip Solder Type Printed Circuit Connector

Dip solder printed circuit connector —Type 310—is the subject of a new engineering data sheet. Electrical and physical characteristics of the unit, materials used, and dimensional drawings are included. 1 page. Lionel Electronic Laboratories, Div. of The Lionel Corp., 1226 Flushing Ave., Brooklyn 37, N.Y.

Print No. Ins. 366 on Reader Service Card

Exhibitors, Tours, Special Events, Other Details Announced for February Insulation Conference

According to reports at a recent general conference committee meeting, most plans and details are nearly completed for the Fourth Annual Electrical Insulation Conference scheduled for the week of February 19th at the Shoreham Hotel, Washington, D. C. Attendance at each conference so far has always exceeded the past year's attendance and it is expected that the number of registrants at the forthcoming meeting will easily break last year's record of some 2,200.

General chairman of the conference is Roger White, The Glastic Corp., Cleveland. Vice chairman-technical is E. L. Brancato, U. S. Naval Research Laboratory, Washington, D. C., while the vice chairman-commercial is A. E. Bohn, Dow Corning Corp., Englewood Cliffs, N. J. Full details on the tentative technical program are given on another page in this issue—information on other activities follows.

Commercial Exhibits

With more than 100 exhibit spaces already assigned, this facet of the conference is already close to a sell-out according to commercial exhibit chairman William J. Dwyer. Firms which have not yet signed up for space may still obtain desirable locations by contacting the chairman at Suflex Corp., 33-40 57th St., Woodside 77, N. Y. Companies planning to exhibit include American-Marietta Co.; Anaconda Wire & Cable Co., Armstrong Resins Inc.; Associated Research Inc.; Belden Mfg. Co.; Bentley-Harris Mfg. Co. Inc.; Brownell Inc.; James G. Biddle Co.; Catalytic Combustion Corp.; Chicago Printed String Co.; Cincinnati Development & Mfg. Co.; Connecticut Hard Rubber Co.; Dodge Fibers Corp.; John C. Dolph Co.; Dow Corning Corp.; Eastman Chemical Products Inc.; Electro-Technical Products Div. of Sun Chemical Corp.; Electro-Technology; Essex Wire Corp.; Exeter Mfg. Co.; FMC Corp.; Ferro Corp.; Formica Corp.; General Electric Co.; The Glastic Corp.; Gudebrod Bros. Silk Co. Inc.; Hays Mfg. Co.; Hess, Goldsmith & Co. Inc.; Hollingsworth & Vose Co.; Hull Corp.; Hysol Corp.

Also Industrial Instruments Inc.; Inmanco Inc.; Johns-Manville Sales Corp.; Lake Publishing Corp. *(Insulation* and *Plastics Design & Processing);* The Macallen Co. Inc.; L. Frank Markel & Sons; Minnesota Mining & Mfg. Co.; Molecular Dielectrics Inc.; Mycalex Corp. of America; National Vulcanized Fibre Co.; New England Mica Co. Inc.; Owens-Corning Fiberglas Co.; Pennsylvania Fluorocarbon Co. Inc.; Permacel; Phelps Dodge Copper Products Corp.; Polygon Plastic Co.; H. K. Porter Co. Inc.; Rayclad Tubes Inc.; Riegel Paper Corp.; Rohde & Schwarz Sales Co. (USA) Inc.; The Russell Mfg. Co.; St. Regis Paper Co.; Schenectady Varnish Co. Inc.; Shell Chemical Co.; The Sterling Varnish Co.; Synthane Corp.; Taylor Fibre Co.; Varflex Corp.; Wabash Magnetics Inc.; and Westinghouse Electric Corp.

Tours

A number of interesting tours have been arranged by the local tours committee chairman, J. D. Rollow, General Electric Co., Washington, D. C. On Monday afternoon, Feb. 19, there will be a tour to the Naval Ordnance Laboratory. A trip to nuclear power reactor at Fort Belvoir is scheduled for Tuesday morning, Feb. 20, and on Tuesday afternoon a tour has been arranged to the Guarded Space Center of the National Aeronautics and Space Administration. Prices of the tours and other details will be announced in the near future.

Awards

As in past years, the Golden Omega Award will be presented to an outstanding national figure responsible for important technological contributions. The presentation will be made at the conference banquet on Wednesday evening, Feb. 21. Shailer L. Bass, executive vice president of Dow Corning Corp., is serving as chairman of the Golden Omega Award Selection Committee. Other committee members include William Rodich, president, Continental-Diamond Fibre Corp.; W. H. Chase, president, American Institute of Electrical Engineers; and Max McGraw, chairman of the executive committee, McGraw-Edison Co. —additional committee members will be announced shortly and it is expected that the recipient will be selected in the near future. Previous recipients were Vice Admiral Hyman Rickover, leader in the nuclear ship program, and Dr. Mervin J. Kelly, former head of the Bell Telephone Laboratories, who had much to do with the development of the transistor.

Plans are also being made to inaugurate a new awards program for the technical papers presented at the conference—details remain to be announced. The over-all awards work and planning is under the direction of W. G. Hoffer, Johns-Manville Corp.

AIEE and NEMA Luncheons

Both the American Institute of Electrical Engineers and the National Electrical Manufacturers Association, co-sponsors of the meeting, are planning luncheons open to all registrants at the conference. The AIEE lunch on Thursday, Feb. 22, will have an international slant and will feature an address by the deputy assistant secretary of commerce for international commerce.

At the NEMA luncheon on Tuesday, Feb. 20, Kenneth W. Haagensen, director of public relations of Allis-Chalmers Mfg. Co., will speak on "We've Got What It Takes, If We'll Only Take What We've Got"—a dynamic presentation covering the elements of public relations, sales, and human relations. One of the industry's most sought-after speakers, Haagensen has held a number of important government and civic positions. The luncheon is being spon-

sored by the NEMA Insulating Materials Division headed by E. R. Perry, president of National Vulcanized Fibre Co.

K. W. Haagensen

Other Activities

The conference banquet under the chairmanship of Walter Hugger, Electro-Technical Products Div., Sun Chemical Corp., is well along as far as plans and speakers are concerned. Full details will be provided next month.

Keynote speaker for the Marketers' program on Monday, Feb. 19, will be an assistant secretary of commerce. A panel presentation with distribution as its theme will be another highlight. Cocktails and a dinner program with a humorous slant are also planned. Harry Rezer, Electrical Maintenance and Equipment Co., is chairman of the marketing meeting.

Conference committees on technical exhibits, education, foreign participation, publications, local arrangements, and promotion have also been very active—reports will be given in future issues.

Negative Ion Studies

Studies of the photodetachment of electrons from negative ions are being made at the National Bureau of Standards, with attention directed toward the cross sections of negative atomic hydrogen ions and negative atomic and molecular oxygen ions. These interactions are important to studies of ionospheric phenomena and themodynamic systems involving very hot gases.

Tallest Vulcanizer for Insulating Electrical Wire

One of the world's most modern facilities for insulating copper and aluminum electrical conductors, a vertical continuous vulcanizer, is housed in a 126-foot tower located near the center of the Bristol (R.I.) works of Kaiser Aluminum & Chemical Corp. It is said to be the tallest and largest vertical "CV" machine in existence.

Natural and synthetic rubber insulating materials are extruded around preheated conductor at the top of the tower and cured in a 75-foot high pressure steam vulcanizing tube extending downward. The cable then continues through a water cooling tube at the same pressure level to improve density of the insulating material.

After traveling vertically, the insulated cable turns on a capstan and is cooled further in a horizontal 65-

foot water tube before being hauled onto a take-up reel at ground level, completing the operation.

The equipment is said to enable Kaiser to insulate larger cables than before—up to 3½ inches in diameter after insulation is applied—and with superior control over surface characteristics, density, centering, and roundness. In addition, the vulcanizer is capable of handling conductor lengths up to 3000 feet, sufficient for virtually any presently known requirement.

The facility will be used for insulating and curing portable cables, building wire, and power cables rated from 600 to 15,000 volts. Insulations for cables rated up to 35,000 volts can be produced.

Dates to Circle

Meeting and Convention Notices

Nov. 6 . . . AIEE, Third Western Technical Conference, Biltmore Hotel, Los Angeles, Calif.

Nov. 6-8 . . . 6th Annual Special Technical Conference on Nonlinear Magnetics, AIEE and IRE, Statler-Hilton Hotel, Los Angeles, Calif.

Nov. 7-9 . . . Eighth Industrial Electric Exposition, Electric League of Western Pennsylvania, Pittsburgh Room, Penn-Sheraton Hotel, Pittsburgh, Pa.

Nov. 13-16 . . . 7th Annual Conference on Magnetism and Magnetic Materials, AIEE and American Institute of Physics, Hotel Westward Ho, Phoenix, Ariz.

Nov. 14-15 . . . Symposium on Ceramics and Cermets—Bodies and Coating, Fall Meeting, Society of Aerospace Materials and Process Engineers, Biltmore Hotel, Dayton, Ohio

Nov. 14-16 . . . IRE, Northeast Electronics Research and Engineering Meeting, Boston, Mass.

Nov. 15-17 . . . Aerospace Electrical Society, Annual Display, Pan Pacific Auditorium, Los Angeles, Calif.

Nov. 16 . . . NEMA, Annual Meeting, Plaza Hotel, New York City.

Nov. 21 . . . Manufacturing Chemists Association Inc., Semi-Annual Meeting and Midyear Conference, New York City.

Nov. 29-Dec. 1 . . . Tenth Annual Wire and Cable Symposium, jointly sponsored by U. S. Army Research and Development Laboratory and Industry, Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 1 . . . SPE, Plastics Screw Injection Molding, Retec sponsored by Cleveland Section, Cleveland Engineering Society Building, Cleveland, Ohio.

Dec. 12-14 . . . Eastern Joint Computer Conference, sponsored by AIEE, IRE, and Association of Computer Manufacturers, Sheraton-Park Hotel, Washington, D.C.

Jan. 9-11 . . . Eighth National Symposium on Reliability and Quality Control, sponsored by IRE, EIA, AIEE, and American Society for Quality Control, Statler Hilton Hotel, Washington, D. C.

Jan. 29-Feb. 2 . . . AIEE, Winter General Meeting and First National Electrical Engineering Exposition, Hotel Statler and the Coliseum, New York City.

Jan. 30-Feb. 2 . . . SPE, 18th Annual Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa.

Feb. 5 . . . Committee Week, Committee D-27 on Electrical Insulation Liquids and Gases, ASTM, Statler Hilton Hotel, Dallas, Texas.

Feb. 6-8 . . . SPI, 17th Reinforced Plastics Division Conference, Edgewater Beach Hotel, Chicago.

Feb. 7-9 . . . IRE, Third Winter Convention on Military Electronics, Ambassador Hotel, Los Angeles, Calif.

Feb. 11-17 . . . National Electrical week, National Electrical Week Committee, 290 Madison Ave., New York 17.

Feb. 15-16 . . . International Solid-State Circuits Conference, AIEE, IRE, and Univ. of Pennsylvania, University Campus and Sheraton Hotel, Philadelphia, Pa.

Feb. 19-22 . . . Fourth Electrical Insulation Conference and Exhibition, Shoreham Hotel, Washington, D. C.

Mar. 14-16 . . . ASTM, Committee D-27, Spring Meeting, Motor House, Williamsburg, Va.

Mar. 19-21 . . . NEMA, Second National Electric Comfort Heating Exposition, Sherman Hotel, Chicago.

Apr. 2-7 . . . Annual Conference, Western Section of SPI, Del Coronado Hotel, Coronado, Calif.

Apr. 4-6 . . . AIEE, South Central District Meeting, Hotel Peabody, Memphis, Tenn.

Apr. 9-10 . . . Rubber and Plastics Industries Conference, Sheraton Hotel, Akron, Ohio.

Apr. 18-20 . . . AIEE, Great Lakes District Meeting, Hotel Van Orman, Fort Wayne, Ind.

Apr. 25-29 . . . Western Space Age Industries and Engineering Exposition, Cow Place, San Francisco.

Apr. 30-May 2 . . . AIEE, Mid-America District Meeting, Hotel Chase, St. Louis, Mo.

May 6-10 . . . Electrochemical Society Annual Meeting, Statler Hilton Hotel, Los Angeles.

May 7-9 . . . AIEE, Middle Eastern District Meeting, Hotel Du Pont, Wilmington, Del.

May 8-10 . . . Electronic Components Conference, sponsored by AIEE, EIA, and IRE, with American Society for Quality Control and Society for Nondestructive Testing participating, Marriott Twin Bridges Motor Hotel, Washington, D. C.

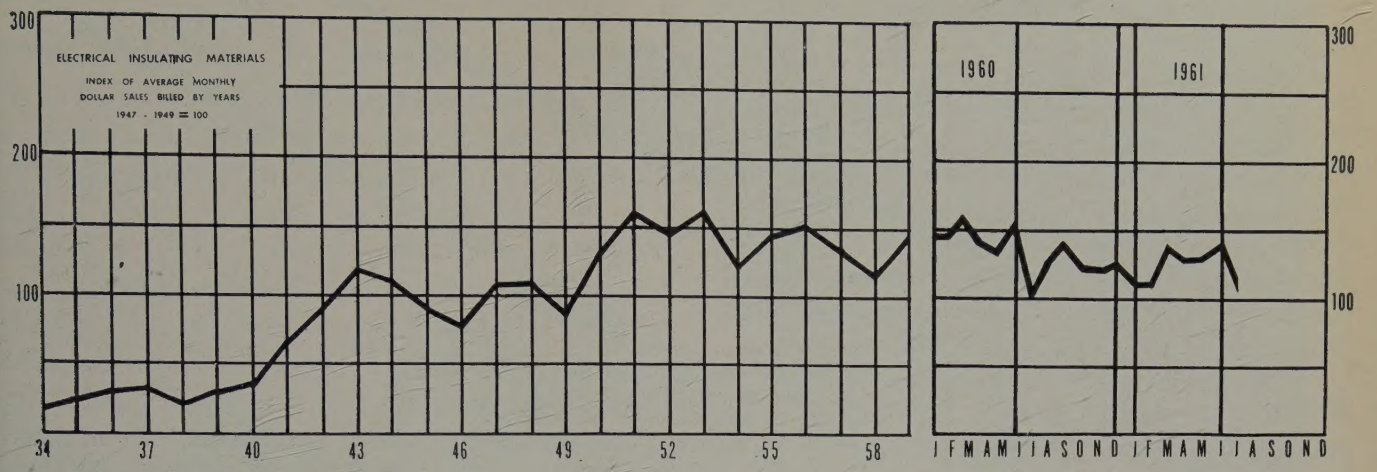
May 9-11 . . . AIEE, North Eastern District Meeting, Hotel Statler, Boston, Mass.

May 10-11 . . . SPE, Workshop on Encapsulation: Materials and Techniques, Newark, N. J.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers	NEMA	—National Electrical Manufacturers Assn.
ASTM	—American Society for Testing and Materials	EASA	—Electrical Apparatus Service Assn.
ASME	—American Society of Mechanical Engineers	SPE	—Society of Plastics Engineers
ASA	—American Standards Assn.	SPI	—Society of the Plastics Industry
IRE	—Institute of Radio Engineers	WEMA	—Western Electronic Manufacturers Assn.
EIA	—Electronic Industries Assn.		

NEMA Electrical Insulation Index



	July '61	June '61	July '60
Index Series	105	139	101
July '61 point change from other mos.		—34	+4
July '61 % change from other months		—24	+4

Index is based on 1947-1949 average month, inclusive= 100

Published through the courtesy of the National Electrical Manufacturers Association

Materials Used in Electrical Insulation Index

Industrial Laminated Products
Manufactured Electrical Mica
Flexible Electrical Insulation
Vulcanized Fibre
Coated Electrical Sleeving

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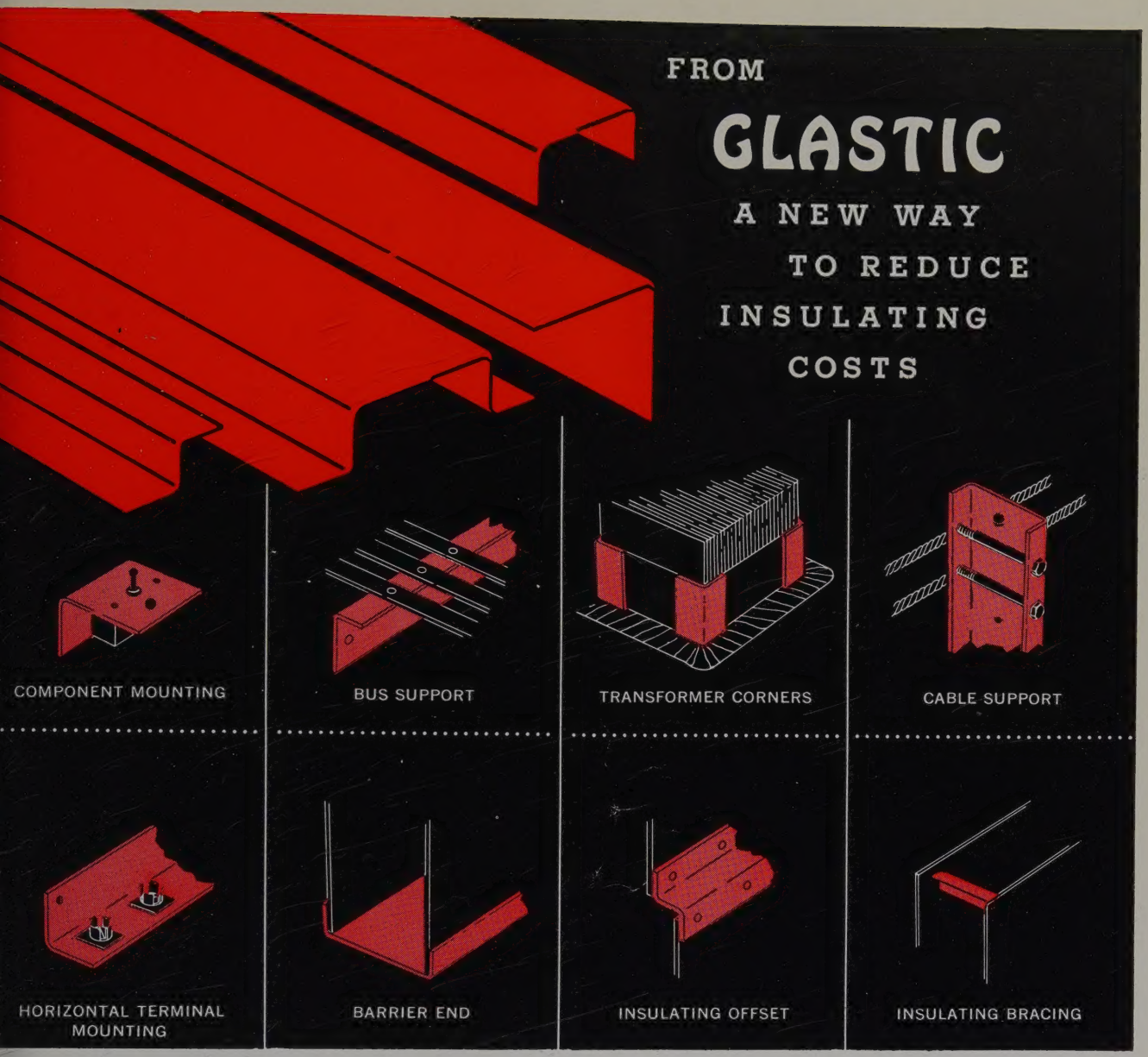

Use versatile channel/angle stock for design flexibility, simplified assembly

The illustrations show typical ways in which Glastic insulating channel and angle stock can serve as product-improving replacements for heavier or more expensive forms—stand-off insulators, wood or insulated metal members.

The high strength stock is available off-the-shelf only from Glastic. It comes ready-to-use in 10 sizes, in widths to 9⅝" and lengths to 76". It can be easily fabricated to meet individual job requirements.

Glastic structural stock is molded of fiber glass reinforced polyester and is engineered for use in equipment operating at Class B temperatures (130°C). It has UL-recognized flame retardance, and properties meet NEMA GPO-1 specifications.

Investigate the cost-saving possibilities of these easy-to-use insulating shapes in your applications . . .

SEND FOR COMPLETE DATA

"Insulating Channel and Angle Stock" Catalog contains application, engineering and price information. Companion catalog describes Glastic line of low cost insulators.

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